Harris, Easton and Schmitt

Brains on the Move

Essays on Human Capital Mobility in a Globalizing World and
Implications for the Canadian Economy

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Richard G. Harris
Nicolas Schmitt

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William Gibson, Dominique M. Gross,
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Policy Study 42

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Contents

Foreword v

Introduction, by *Richard G. Harris* vii

Who Goes There? Canadian Emigration to the United States in the Twenty-First Century, by *Stephen T. Easton* 1

Where Canadian Scientists Work, by *Stephen T. Easton* 13

Where Canadian Economists Work, by *Stephen T. Easton* 33

Canadian Students in the United States, by *William Gibson* 41

Costing the Brain Drain, by *Richard G. Harris* 55

Competition for Foreign Talents and International Labour Mobility, by *Nicolas Schmitt and Antoine Soubeyran* 99

Cultural Clustering, Skills, and International Labour Mobility, by *Dominique M. Gross and Nicolas Schmitt* 115

Labour Mobility and a North American Common Market: Implications for Canada, by *Richard G. Harris and Nicolas Schmitt* 133

About the Authors 175

Members of the C.D. Howe Institute 179

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Foreword

Economic growth depends very much on the availability of talent. During the 1990s, with a sharp increase in the migration of young and highly educated Canadians to the United States and other countries, much angst arose in Canada regarding a potential "brain drain." The pick-up of migration — significant but not a large portion of the population — was a result of a precipitous decline in per capita income in Canada relative to that in the United States during the period between 1988 and 1997.

After 1997, Canada's per capita income rose at a faster pace, and the "brain drain" discussion virtually disappeared from public view. In the past two years, however, Canada's productivity has slowed and the gap between Canadian and US per capita incomes has widened, sparking renewed concerns about the migration of highly qualified individuals and entrepreneurs into and out of Canada.

In this volume, we are treated to a review of a number of issues that affect the mobility of talent. The essays provide analyses of the importance of labour mobility to the economy, and they draw several important policy conclusions from the discussion.

As Richard Harris notes, the integration of labour markets in North America will continue to be a trend worth noting, and will require policy responses in the future. Canada does succeed in bringing migrants from non-OECD countries who are attracted to communities here, but migrants from other OECD countries will come only if the economic opportunities here are superior. Entrepreneurial inflows will be a special challenge.

I wish to thank Richard Harris for developing this book. I also thank Barry A. Norris for editing and preparing the manuscript for publication, and Wendy Longsworth and Diane King for their production assistance. The C.D. Howe Institute is grateful to the Donner Canadian Foundation for its support of this project, and to the John Dobson Foundation for its support of Richard Harris's scholarship.

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Jack M. Mintz
President and
Chief Executive Officer

Introduction

Richard G. Harris

In the 1980s, as trade was being liberalized around the world, Canada was in the forefront of that trend with the implementation of the 1988 Canada-US Free Trade Agreement. At that time, there was a great deal of concern as to how free trade would affect the location of industry. Smaller countries in particular were concerned that they might be de-industrialized when faced with large market competition — "industry on the move" was one of the catch phrases of the era.

As globalization proceeded in the 1990s, there was a subtle but important shift in policy concern. It became increasingly evident that economic growth was being driven less by the accumulation of capital and population and more by ideas and new technologies. The era of the "New Economy" and the large productivity gains evident in the US economy and elsewhere raised the stakes in the global competition to acquire knowledge and develop leading-edge technology. It was also becoming evident that "brains on the move" was as important as "industry on the move." Highly skilled professionals and technical workers were moving about the globe at a surprising pace. The technology boom in the United States was attracting many of these types of workers from Europe, Asia, the former Soviet Union, and, by the late 1990s, from Canada as well.

The research presented in this volume started in the midst of the great Canadian brain drain debate that began around 1998. Although a substantial theoretical and policy literature on the brain drain already existed, Steve Easton and I were convinced that something "new" was happening in global labour markets. At the same time, we were concerned about the possibly askew interpretation that was being given to the emerging numbers on the brain drain from Canada.

The early evidence suggested that the aggregate flow of the highly skilled from Canada to the United States was relatively modest by historical standards and more than offset by the inflow of immigrants. Our main concern, however, was that the aggregate data were masking a more fundamental shift in the type of labour flow that was occurring. In particular, we felt that defining as "skilled" someone who simply had a college degree was hardly sufficient to deal with the reality of the New Economy. Clearly, detailed data on professionals and selected occupational groups were needed. Moreover, we were convinced that the existing theoretical framework based on the shift of the labour supply within an otherwise static economic model was seriously out of date.

With these concerns in mind, Easton and I had a series of conversations with Patrick Luciani, then director of the Donner Canadian Foundation. The Foundation subsequently offered to provide generous support of a research program to address some of these concerns and to take a new and different look at the issues. This volume is the result of that research.

Although the brain drain debate raises legitimate policy concerns, Canadians should not be alarmed by the scope of this flow of skilled labour. As Steve Easton discusses in the first essay of the volume, Canadians have always moved a lot, particularly to the United States. In the second and third essays, Easton looks at scientists and economists, two groups for which he obtained a unique data set. Although, at first glance, one might question the specific focus on these two groups, it makes sense when one considers that Scott and Grubel studied economists in their pioneering work on the Canadian brain drain in the 1960s, while scientists are among the principal drivers of technological change and global knowledge flows.

Easton's conclusions are not encouraging. He finds that Canadian scientists are now more than twice as likely to be relocated from Canada than they were in the 1960s, while economists have also seen a dramatic increase in the likelihood that they will take employment outside Canada. His results, if corroborated by evidence on other highly skilled occupations, suggest the brain drain problem could be more significant than we realize.

Since talent is not just born but also created, an important part of the brain drain debate is the role of Canada's education system and the effect of increasing economic integration with the United States on the creation of human capital in Canada. Accordingly, in the fourth essay, William Gibson takes a novel look at an increasingly important aspect of Canada-US integration: the decision by Canadians to obtain at least a part of their education in the United States. Gibson observes that, relative to people from other countries, Canadians' propensity to study in the United States is large and growing. Moreover, the flow is highly asymmetric: six times as many Canadians obtain their education in the United States as Americans study in Canada even though our southern neighbour has eleven times Canada's population. As Gibson notes, to the extent that the choice of educational location affects subsequent choice of employment location, this trend could be part of the reason for underestimating the size of the flow of young Canadian brains to the United States. He also notes that Canadians who study south of the border are predominantly in graduate and postgraduate professional degree programs, unlike foreign students in Canada, most of whom are in undergraduate studies. Again, this trend suggests that Canada is losing its best and brightest.

In the fifth essay, I take up the question of the welfare significance of the international flows of skilled labour. I point out that, using traditional cost-benefit analysis based on a neoclassical factor supply framework, it is virtually impossible to conclude that the shifts in the observed flows of aggregate skill groups, as measured by educational attainment, are of welfare significance. These results can be misleading, however, for two reasons. First, there may be a selection bias in the group choosing to leave. If Canada is losing individuals who are economic superstars, the impact could be large even if the total number is quite small — think of this as the "Wayne Gretzky model" of the brain drain. Why this might be occurring is related in part to the increased role of human capital in the overall economy and to the increasing size of knowledge industries in both the United States and Canada. The second, related, factor is the importance of knowledge spillovers: highly talented individuals are particularly critical in the links that facilitate international knowledge flows — Easton's scientists are a classic example. Evidence is accumulating that knowledge spillovers are an increasingly important driver of economic growth. Linking this with the superstar phenomenon, I develop a theory that the income gap between Canada and the United States is being sustained by a permanent knowledge gap between the two countries, which, in turn, is the result of Canada's failure to retain its own share of superstars.

In the sixth essay, Nicolas Schmitt and Antoine Soubeyran develop an alternative approach to the same issue, with a focus on entrepreneurs. Part of the Canadian debate on taxes and economic integration is the concern that Canada is losing the race to retain entrepreneurs — a particular worry at a time when new industries are emerging. Schmitt and Soubeyran point out the important links that exist between the available supply of talent for entrepreneurship and the productivity of new firms that entrepreneurs create. In a world in which entrepreneurs can migrate to a choice of destinations, policy changes in any destination country will affect the quality of the pool of entrepreneurs it is able to attract. Thus, for example, if the United States were to lower effective tax rates on new entrepreneurial activities, the quality of potential entrepreneurs attracted to Canada would be expected to decline. Schmitt and Soubeyran also highlight the important issue of different degrees of mobility among different types of people. If entrepreneurs in a particular country become more mobile than labour in general, that country could see an exodus of its most talented entrepreneurs, which, in turn, would reduce the aggregate productivity of firms set up by entrepreneurs who chose not to leave. This important theoretical observation is yet another reason that the increased mobility of brains could be having asymmetric effects on growth from one country to another — some countries are benefiting while others are losing.

Although most of the essays in this book are concerned with economic factors that drive labour mobility, noneconomic factors play an important role; however, relatively little systematic evidence exists on this issue. In the seventh essay, Dominique Gross and Nicolas Schmitt look at the effect of "cultural clustering" on immigration decisions using a sample of countries that are members of the Organisation for Economic Co-operation and Development (OECD). They find that cultural clustering has a positive effect on immigration from a non-OECD country to an OECD country — in other words, that migrants are attracted from the former to the latter. Moreover, immigrants are more likely to move to a country that contains a cultural group with which they can identify. At the same, time, however, Gross and Schmitt can find no such effect when looking at immigration from one OECD country to another. For the Canadian brain drain debate, the policy implication of this result has largely to do with the demand effects of immigration policy: Canada could make itself a relatively more attractive destination for some types of internationally mobile labour by encouraging cultural clustering, although it appears that such a policy would have little effect on potential migrants from OECD countries.

There is, in addition, a distinction to be drawn between policies that affect permanent migration and those that affect the mobility of business persons and other highly skilled specialists. Historically, most countries have used immigration policy as a tool for national economic development by attempting to manage the supply of labour. With globalization, however, two new trends have emerged. First, the very highly skilled appear to be *de facto* globally mobile even in the presence of immigration controls because of the high demand for their skills in virtually all industrial countries. Second, demands are increasing to recognize formally and to enshrine within regional integration agreements a more liberal regime with respect to crossnational labour movements — the European Union, for example, has enshrined labour mobility rights explicitly in its legal framework. Of course, most federations, including Canada, permit some degree of labour mobility between subnational jurisdictions. Now, however, the issue of increasing global or regional labour mobility — either *de facto* through globalization and technological change or *de jure* through explicit economic integration agreements — is one with which many governments are grappling.

It is frequently suggested, for example, that the North American Free Trade Agreement be extended to cover free trade in labour as well, an issue that I discuss to some extent in the fourth essay and that Nicolas Schmitt and I examine in more detail in the eighth and last essay in this book. Smaller countries fear that, in entering into an economic integration agreement with free movement of labour, they might suffer a serious and permanent brain drain to larger partners. It is worth noting, however, that small EU countries such as Ireland have had exactly the opposite experience, and Schmitt and I come to similar conclusions regarding Canada. A permanent credible commitment to the free movement of labour is more likely, on both historical and theoretical grounds, to raise the real income of a small country that enters a large economic area.

It is still an open research question as to how the dynamics of this labour mobility process would work out. Certainly, Easton's evidence suggests that the brain drain is having a negative effect on Canada, and my own work suggests the economic costs of this effect could be large. Moving to a regime of permanent and complete labour mobility between Canada and the United States could lead to two types of adjustment. In the first case, labour could flow out of Canada until growing labour scarcity in Canada reduced the wage gap between the two countries. In the second case, jobs and investment could move to Canada to meet the supply of Canadian-grown brains. Policymakers would not be neutral between these two options, but would strongly prefer the latter. What is clear is that the tension this creates for both domestic and international policy is not likely to diminish soon.

The North American economic integration agenda — particularly that of the United States and Canada — clearly has been stalled since the September 11, 2001, terrorist attacks. At some point in the near future, however, the possibility of a Canadian initiative on the economic integration front is more probable. Wendy Dobson and I have discussed some ideas on such an initiative elsewhere.* Deeper economic integration between Canada and the United States — involving movement toward some form of customs union, for example — would require, as a matter of practical business necessity, that policymakers address the issue of enhancing the free movement of business and skilled labour. Going beyond a customs union toward, say, a common market framework seems a remote possibility now, given that tightening border security is the current concern of our southern neighbour. Nevertheless, in most liberal democracies, the long-run trend — at least since the end of World War II — has been the increased international mobility of labour.

At some point in Canada's future, perhaps sooner than we think, the prospect of an integrated North American labour market will become a matter of active policy debate. Moreover, that debate will rival in intensity the one Canadians had in the 1980s on free trade with the United States. We hope this book will help to articulate what is at stake for Canadians in terms of greater North American labour market integration and of the impact of globalization on Canadian labour markets more generally.

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* See Wendy Dobson, "Shaping the Future of the North American Economic Space: A Framework for Action," *C.D. Howe Institute Commentary* 162 (Toronto: C.D. Howe Institute, April 2002), and Richard Harris, "North American Economic Integration: Issues and Research Agenda," Industry Canada Discussion Paper 10 (Ottawa, April 2001); available at web site: http://strategis.ic.gc.ca/sc_ecnmy/mera/engdoc/02b.html.

Who Goes There?
Canadian Emigration to the United States in the Twenty-First Century

Stephen T. Easton

Throughout Canada's history, Canadians have moved to the United States in noticeably large numbers, a fact about which Canadian politicians have always been rather touchy. As Canada was an integral part of the British Empire, the emigration of Canadians to the United States was patently against the Mother Country's efforts to populate her North American colonies and of the colonies themselves to resist US aggression. Indeed, population growth through immigration was a central feature of the policies of the British North American colonies and of the Canadian government after Confederation.

Of course, the rapid growth of the United States and the two countries' extensive common border made it impossible to prevent economic intercourse. From contact grew cohabitation and the gentle mingling of populations. In the late nineteenth century, there was no effort to prevent movement across the border, and regulation of immigration between Canada and the United States was effectively nonexistent. In fact, for the entire decade of the 1890s, the record of inflows from and outflows to the United States is a creative fiction.

At the turn of the twentieth century, the number of immigrants to Canada began to grow rapidly, populating the Canadian West and providing markets for domestic manufactures and staple exports from a newly invigorated Western agriculture. Canadian politicians were pleased with the social and economic changes that a growing population permitted, but were increasingly concerned about the ethnic makeup of those who were arriving and those who were leaving for the United States. The issue was about "quality" and, make no mistake about it, it had a distinctly racist flavour. Those who were leaving for south of the border typically were of British ancestry and had been born, bred, and educated in Canada. The new arrivals who were taking their place were less educated, less homogeneous, and less easily assimilated. Restrictions on immigration and immigrants from certain countries — notably China, Japan, and later India — left no doubt about the character of the immigration debate.

Concern about Canadians leaving for the United States is thus an old one. Echoes of the arguments about emigration made a hundred years ago still resonate, reflecting their grip on Canadians' basic instincts. Why do we care who is here and who goes there?

To answer these questions, one must have a sense of what a country is. Are we still who we are if our sons and daughters leave, to be replaced with immigrants who do not share our history? Are we a common people? Do we have sufficient shared geographic, economic, and social experiences to permit us to remain a single nation? For that matter, could we even fragment into just two parts — English and French? Does the nation as we have developed it since the latter part of the twentieth century hold the seeds of its own demise?

The nature of immigration to Canada and emigration from it figures prominently in this discussion. Above all, though, this is a study of emigration, and once again the issue is one of "quality." Unlike a hundred years ago, however, "quality" is not about race, but about human capital, personal gain, and the entrepreneurial spunk of Canadians. Have we created an environment that discourages Canadians who are at the cutting edge of technology and economic development from staying? Can we find evidence for the observation that the best and the brightest are heading to the United States, where the opportunities are more promising and the personal rewards greater?

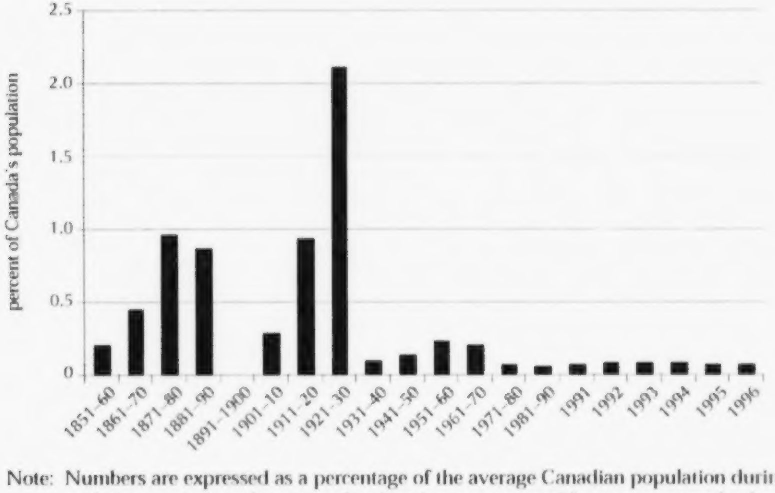
It is impossible to answer these questions definitively. What one can hope to see, however, are some indicators of the direction in which things are going. This is half a loaf, but it is better than none. The difficulty is that the evidence is primarily about the quantity, rather than the quality, of the people who are leaving. In the following two essays in this book, I look at the examples of scientists and economists, two groups of people who are heavily endowed with what is termed "human capital," but it is important to understand what all the current fuss is about. We know that doctors and nurses are constantly (and accurately) portrayed as sliding across the border, but others travel south as well, and their paths have yet to be described.

People move across the border in many ways that are not easily identified in the short term. But, we think, move they do. The expansion of economic opportunities created by the stunning resurgence of the US economy and a tax regime that permits US taxpayers in the higher-income brackets to benefit from success provide persistent incentives to move. And those who have something to offer will be the first to benefit from the new economy, regardless of their nationality. Canadians have noticed, and the best and the brightest are on the march. Or are they?

Flows from Canada to the United States

As a percentage of the average population, far greater numbers of Canadians emigrated to the United States in the past than in recent years, as Figure 1 shows. A hundred years ago, Canadians flooded southward at the rate of 1 to 2 percent of the country's population every year. Since the end of the 1920s, however, emigration to the United States appears to have slowed to a trickle: during the 1950-80 period, it averaged 0.2 percent of the population per annum; in the 1990s, it averaged a mere 0.07 percent — less than one-tenth of

Figure 1: ***The Emigration of Canadians to the United States, 1851–1996***



Note: Numbers are expressed as a percentage of the average Canadian population during each time period, so that rates of emigration are comparable average annual values.

Sources: Statistics Canada 1983, continued in CANSIM data series D1; United States 2000, 22–23.

1 percent — each year. But trends relative to the population over such long periods may not show more recent patterns very clearly.

Figure 2 shows the number of Canadians who emigrated to the United States over the past 50 years. Two things catch the eye immediately. First, in terms of absolute numbers, the most popular time to leave was the mid-1960s. Second, there has been a steady trend upward in the number of emigrants since 1990.[1]

Absolute numbers are one way to see the story. Another way is to look at the ratio of emigrants to Canada's total population (see Figure 3). Although slightly attenuated, the evidence is clear that the increase in emigration over the past decade is not simply an artifact of the growth of the population over that time.

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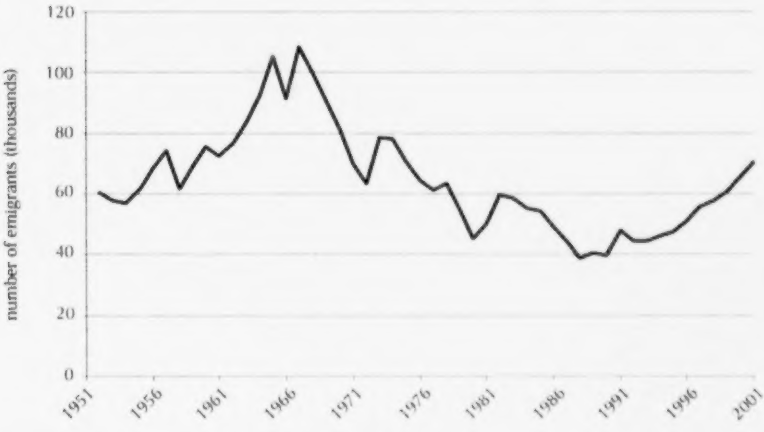
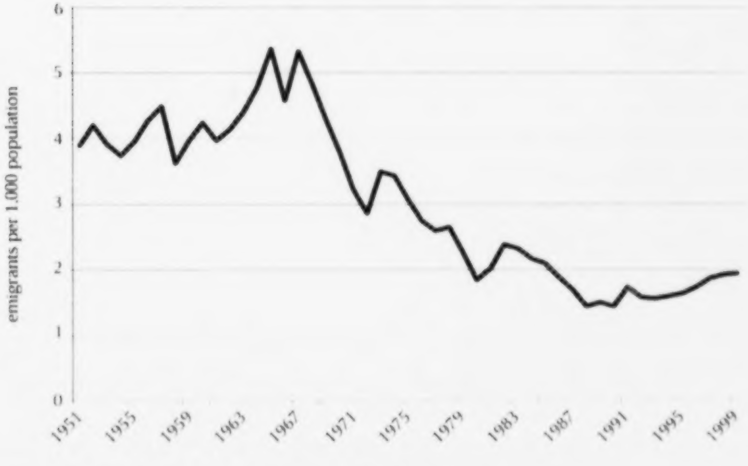
[1] But outflow is not everything. Were one to plot immigration as well, one would find that Canada has had more immigrants than emigrants over the past few decades — since 1960, an average of 2.7 times as many immigrants as emigrants (Statistics Canada, CANSIM database series D74 and D123082).

Figure 2: ***The Number of Canadians Who Emigrated to the United States, 1953–2001***



Source: Statistics Canada, CANSIM data series D123082.

Figure 3: ***Canadian Emigrants to the United States per 1,000 Population, 1951–1999***



Source: Statistics Canada, CANSIM data series D1, D123082.

Table 1: ***Permanent and Temporary Admissions from Canada to the United States, 1989–96***

	FTA and NAFTA Admissions	Normal Immigration	Ratio of Temporary Admissions to Permanent Immigration
1989	2,817	12,151	0.23
1990	5,887	16,812	0.35
1991	8,900	13,504	0.66
1992	13,809	15,205	0.91
1993	19,092	17,156	1.11
1994	30,870	16,068	1.92
1995	31,106	12,932	2.41
1996	34,681	15,825	2.19

Note: Admissions under the FTA began January 1989 and ended December 31, 1993; admissions under NAFTA began January 1, 1994.

Source: United States 1999, tables 3, 39.

Other evidence tends to tell a similar story. As Table 1 shows, since the implementation of the Canada-US Free Trade Agreement (FTA) in 1988 and the North American Free Trade Agreement (NAFTA) in 1994 and resulting changes in institutional arrangements for Canadians wishing to work in the United States, it appears that greater numbers of Canadians are leaving for south of the border. The jury is still out, however, on whether the increase in so-called NAFTA admissions — through temporary working permits that are comparatively easy to get in a free trade environment — are really the same as legal immigration numbers. A further uncertainty arises since multiple entries are recorded as separate events. It is thus difficult to know how significant has been the change in the number of visa entries in recording a change in Canadians' responses to employment opportunities in the United States, rather than simply recording the changing structure of doing the same work with the convenience of multiple entries. Nonetheless, there has likely been an increase in Canadians either moving to or working in the United States.

Further evidence suggesting an increase in the number of Canadians leaving for the United States is shown in Table 2, which

Table 2: ***Number of Canadians Leaving for the United States, 1991–97, Estimated from the Number of Tax Filers***

	Number of Tax Filers Leaving Canada for the United States *(1)*	Estimated Number Remaining in the United States *(2)*	Number of Leavers, Including Family, Remaining in the United States *(1.3 × column 2)*
1991	15,360	12,000	15,600
1992	18,740	14,600	19,000
1993	19,320	15,100	19,600
1994	20,830	16,300	21,200
1995	22,090	17,300	21,200
1996	26,860	21,000	27,300
1997	28,870	22,600	29,300

Note: It is estimated that as many as 78 percent tax filers who leave for the United States choose to remain there.

Source: Finnie 2001, fig. 2.

presents data on tax filers. Estimates by Finnie (2001) suggest that, in the 1990s, there was a significant increase in the number of Canadians heading to the United States.

Although the flow of Canadians southward is not a new phenomenon, what is of current interest is whether the apparent increase in emigrants in recent years is real and substantial. Moreover, the issue is not so much one of numbers, since they are relatively small by historical standards, but of "quality": are the best and the brightest on the move?

Who Are They? The Current Stock of Canadians Living in the United States

In recent years, both the absolute number of the Canadian-born living in the United States and the Canadian-born as a share of all foreign-born in the United States have fallen, as Table 3 shows. In 1990, about 772,000 people living in the United States identified their origin as Canadian; by 1996, this number had fallen to 660,000. Of these, 345,000 (or about 52 percent) had not chosen (or were not

Table 3: ***Estimated Number of Canadians and Other Foreign-Born Living in the United States, 1990 and 1994–97***

	Canadian-Born	All Foreign-Born	Canadians as a % of All Immigrants in the United States
	(thousands)	*(thousands)*	*(%)*
1990	772	19,767	3.9
1994	679	22,568	3.0
1995	677	24,493	2.8
1996	660	24,557	2.7
1997	542	25,779	2.1

Source: Schmidley and Robinson 1998, table A7.

Table 4: Canadian-Born Living in the United States, 1996

Age Group	Canadian-Born US Residents Who Are Now US Citizens	Number
	(%)	*(thousands)*
18 to 24	13	30
25 to 29	29	42
30 to 34	25	51
35 to 44	35	142
45 to 64	48	172
65+	84	183

Source: United States 1997, table 5.

yet eligible) to obtain US citizenship. As Table 4 shows, however, as they get older, Canadians living in the United States increasingly tend to become US citizens: the share that takes out US citizenship increases by 1.2 percentage points for each year of age.

Another interesting point that illustrates the gradual movement of Canadians to the United States is that, as a percentage of the total Canadian population, the share of the Canadian-born living south of the border increases with age (see Table 5). It is understandable — as a function of vacation habits, climate, and medical care — that older and retired Canadians would choose to live in the

Table 5: ***Canadian-Born Population in the United States as a Share of Canada's Population, 1996***

Age Group	Canadian Population in Age Group	Canadian-Born in Age Group	
		Living in the United States	Share of Canada's Population
	(thousands)	*(thousands)*	(%)
18 to 24	2,810	30	1.1
25 to 29	2,164	42	1.9
30 to 34	2,582	51	2.0
35 to 44	5,002	142	2.8
45 to 64	6,327	172	2.7
65+	3,582	183	5.1

Sources: Statistics Canada, CANSIM data series D1; United States 1997, table 5.

United States in greater numbers than those who are younger. What the table does not reveal, however, is whether current cohorts are moving southward to the same degree as Canadians did in earlier days.

Although it is hard to square with the supposed superiority of Canadian social programs, especially health care, over US programs, it is a fact that, as Table 5 shows, more than 1 in 20 of Canada's population ages 65 and older is now living in the United States. If we consider that roughly 20 percent of Canada's population was not born in this country, the fraction of the Canadian-born ages 65 and older living in the United States is even larger.

Canadian immigrants to the United States differ from those from other countries, as Table 6 shows. For example, almost half of all Canadian immigrants go southward for employment-related reasons, compared with 13 percent of immigrants as a whole. Refugees make up a significant 14 percent of all arrivals, but the number of Canadians among them is, not surprisingly, negligible.

A snapshot of the Canadian-born who were living in the United States at the time of the 1996 census, shown in Table 7, presents some interesting features. The first notable observation is that there were nearly twice as many women than men. Second, 28 percent

Table 6: ***Emigration to the United States from Canada and All Countries, By Type, 1996***

	From Canada		From All Countries	
	Number	Share of Total	Number	Share of Total
		(%)		(%)
Total	21,751		915,900	
Family-sponsored	2,783	12.8	294,174	32.1
Employment-based	10,645	48.9	117,499	12.8
Immediate relatives of US citizens	7,084	32.6	300,430	32.8
Refugees	35	0.2	128,565	14.0

Source: United States 1997, table 5.

had a bachelor's, graduate, or professional degree, compared with 23 percent of the US population over age 25 generally, so that Canadians are relatively well educated. At the same time, however, many of the Canadian-born were in the lower-income classes, which could be a reflection of the much higher ratio of women to men, since women, on average, tend to have lower incomes than men. (Per capita income in the United States in 1996 was US$24,660.) On the other hand, only 2 percent of the Canadian-born received public welfare, a rate lower than that in Canada or for the US population as a whole. Moreover, only 7 percent were below the poverty line, compared with 13.7 percent in the United States generally.[2] In short, Canadians living in the United States as of 1996 could be characterized by their good education and general lack of poverty relative to the US population as a whole.

Concluding Comment

In this short overview, I have described the magnitude of the flow of Canadians to the United States and offered a snapshot of the

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[2] US data are drawn from United States (2000b, tables 722, 249, 760).

Table 7: ***Characteristics of the Canadian-Born Living in the United States, 1996***

	Number in Category	Percentage in Category
	(thousands)	*(%)*
Total Canadian-born	660	
Males	227	34
Females	433	66
Educational attainment		
Not a high school graduate	90	14
High school graduate or some college	318	48
Bachelor's degree	110	17
Graduate/professional degree	71	11
Income in 1995 (US dollars)		
Under age 16 or without income	70	11
\$1 to \$9,999 or loss	173	26
\$10,000 to \$19,999	127	19
\$20,000 to \$34,999	140	21
\$35,000 to \$49,999	50	8
\$50,000+	100	15
Public assistance income		
No public assistance income or under age 16	648	98
Received public assistance income	12	2
Poverty status		
Below poverty line	48	7
Above poverty line	611	93

Source: United States 1997, table 6.

characteristics of at least the Canadian-born among them and how they compare both with other immigrants and to the US population as a whole. In terms of the debate about the "brain drain," however, the question is not so much whether there is a massive flow of Canadians southward, but whether those who leave diminish Canada in a way that is disproportionate to their numbers.

To gain some insight that might help to answer that question, it would be useful to look, not at the general sample of Canadians living in the United States, but at a couple of specific, highly skilled groups of individuals — namely, Canadian scientists and economists — to see where they choose to work. That is the subject of the next two essays in this study.

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Where Canadian Scientists Work

Stephen T. Easton

The emigration of Canadians to the United States has been, and continues to be, a topic of hot debate.[1] Do taxes cause emigration? Does the relative lack of opportunities writ large in Canada cause emigration? Is Canadian economic activity in any dimension significantly affected by outflows of highly skilled labour once inflows of human capital have been taken into account? Even if the outflows are small, are they occurring among Canada's "best and brightest" in fields such as science and economics, and is Canada heading for economic or scientific mediocrity as a result?

That a brain drain, according to theory, can have deleterious effects is relatively clear, but the empirical evidence needed to form a conclusion about the magnitude of those effects remains difficult

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This essay is based on a paper of the same title presented at the Canadian Law and Economics Association Meetings, Toronto, 2001.

[1] DeVoretz and Laryea (1998); DeVoretz (1999); Helliwell (1999); Iqbal (1999); Wagner (2000); and Finnie (2001) are among those who have squared off about the size and significance of emigration flows.

and ambiguous. From the perspective of the country experiencing a brain "gain," more of *any* factor of production — whether labour, capital, or human capital — is good since it gives rise to opportunities for gains from trade with other factors of production.[2]

After this point, however, the theory becomes less clear. Real income gains depend on the magnitude of the various "imperfections" in the factor markets. For example, the usual theory assumes that factors receive their marginal products — that is, for every increase in the stock of labour, the wage reflects labour's contribution to increased output. In Canada today, however, that is a tenuous assumption given the wealth of government programs designed to stimulate, ameliorate, and otherwise frustrate the market-wage outcome.

Similar problems adhere to returns to capital and land. An analysis of the precise consequences of an increase in the stock of labour — or, in the case of emigration, declines in the stock of labour or, more appropriately, in the case at hand, the stock of human capital — is possible in principle but difficult in practice because of the various cross-subsidies and taxes in the system. Other issues also complicate the task of assessing the consequences of emigration. Usher (1977) points to the "crowding" of public goods: there is imperfect labour mobility internationally and impediments to mobility within Canada itself in the trades and some professions. As a result, although tax policy, research funding, quality of life, educational funding, and many other issues are obviously potentially important in determining current stocks and flows of Canadian human capital, we have only the barest hint of the empirical magnitudes determining the flow of emigrants, despite the best efforts of scholars.

Does Canada have a "brain drain" problem today? Even though the "gain" may not seem very large to the United States, the loss can be large for particular countries. Grubel and Scott (1977) point out that, in the early 1960s, nearly 30 percent of Canadians whose first degrees were in science or engineering were working in the

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2 See Jones, Coelho, and Easton (1986) and Jones and Easton (1990) for examples of different models. It is usually assumed that migrants also gain, otherwise they would have remained where they were.

United States, although they also note that many Canadians who receive their training in the United States later return to Canada, so the story is a complex one. The debate, in any case, appears to be more about the quality, rather than the quantity, of those who are leaving, although some quantity-related issues remain to be settled.[3]

The approach I take in this essay is to look, not at aggregate outflows of emigrants, but specifically at scientists, a well-educated subset of the general population that, by any measure, embodies a wealth of human capital. I examine emigration patterns that have emerged over the past 50 or so years, with a particular focus on recent years.

The Data

The scientists I look at are drawn from *American Men and Women of Science* (Hallard 1998, hereafter referred to as AMWS), which lists a total of 119,618 scientists in Canada and the United States. Scientists on that list are "limited to those who have made significant contributions in their field," must be "distinguishedby reason of experience, training or accomplishment" as exemplified by research activity or position of substantial professional responsibility, and are selected from suggestions solicited from "leaders of academic, government and private research programs and associations" (xiii).

Such a data set provides a rich source of information for research about the brain drain. As will become apparent, however, since its selection criteria emphasize scientists who have already built substantial reputations, bright young scientists who are currently making their way are not as likely to be represented, which is a serious limitation when one is examining very recent flows of such brains.

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[3] For example, it is difficult to know whether Canadians who obtain short-term free-trade-related visas allowing them to work in the United States intend eventually to emigrate or remain in Canada. They may be using their skills in the United States, but the welfare implications for Canadians who do not emigrate potentially are different if the visa recipients stay in Canada or depart.

Biographical information included in AMWS permits one to explore some questions about international migration, although the entries do not provide complete employment histories. Most entries, however, provide information on the scientist's country of birth, where and when he or she went to school, where he or she currently works, some indicator about the scientist's field of specialization, and degrees received. Accordingly, I use these variables as the primary workhorses of the analysis.

Notably missing are variables that are near and dear to every economist's heart: measures of the income opportunities in Canada and the United States afforded each scientist, the research money available to them, and other aspects of the quality of the research and personal environment available in each country. Without this kind of individual data, the relationships one is able to discover are attended with a great deal of variation. That is, since one is forced to ignore key factors in an individual scientist's location decision, it is difficult to predict in which country a scientist will locate. Nonetheless, the variables I identified above do have a significant association with the choice of location, and shed some light on the brain drain issue.[4]

The Sample

From the nearly 120,000 scientists in the listing, I extracted a sample of 6,887, or roughly 5.8 percent, who had a discernable Canadian connection — namely, those who were born in Canada, who listed some of their training as having taken place in Canada, or who were working in Canada at the time of the survey; the sample is broken down in Table 1.[5]

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[4] In more technical terms, the explained variation, the R^2 type of measure, is expected to be low, but statistically significant t-values are found on some of the coefficients.

[5] Some of the sample could not be used if I could not find complete information on each of a number of variables of interest. Accordingly, when particular variables are of interest, the sample size can be smaller than 6,887.

Table 1: ***Canadian Connections in the Sample of Scientists***

	Born in Canada		
	Yes	**No**	**Total**
Work in Canada			
Yes	2,862	1,430	4,282
No	1,211	1,384	2,595
Total	4,073	2,814	6,887

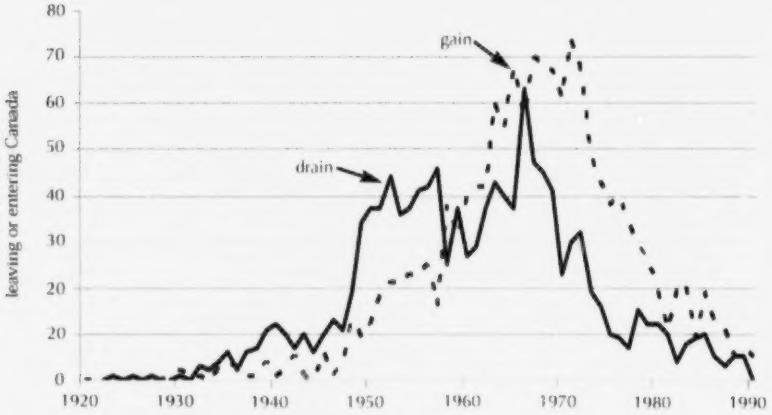
Source: Sample drawn from Hallard 1998.

The scientists in the sample span a wide range of ages and expertise. The distribution of birth dates ranges from 1896 to 1967, with the average being about 1935. Consequently, since the listing dates from 1998, the scientists have an average age of 63, which reflects the selection criteria noted above and the lack of younger, up-and-coming scientists. Because the scientists classify themselves into dozens of fields and subfields, I aggregated the classifications into 18 categories, which not only give a flavour of the fields and types of work being done but also are useful to see whether scientists with certain types of expertise are more likely to work in Canada or abroad. The categories are: physics, chemistry, mathematics, medicine, biology, aeronautics, agronomy, physiology, animal research (farm), ecology, earth sciences, geology, computer sciences, electrical engineering, administration, education, applied sciences, and engineering. Many scientists fit into more than one category — for example, mathematical biology spans both mathematics and biology, while biochemistry spans both biology and chemistry.

A Preliminary Look at the Gross Flows in the Sample

The overall pattern of the flow of recognized scientists to and from Canada is shown in Figure 1. As is apparent from the picture, the drain of scientists from Canada began in the 1930s and continued to the mid-1950s. From that point on, Canada was a beneficiary of scientists. What is striking, however, is that both levels are broadly

Figure 1: ***Canada's Scientific Brain Drain and Gain, 1923–90***



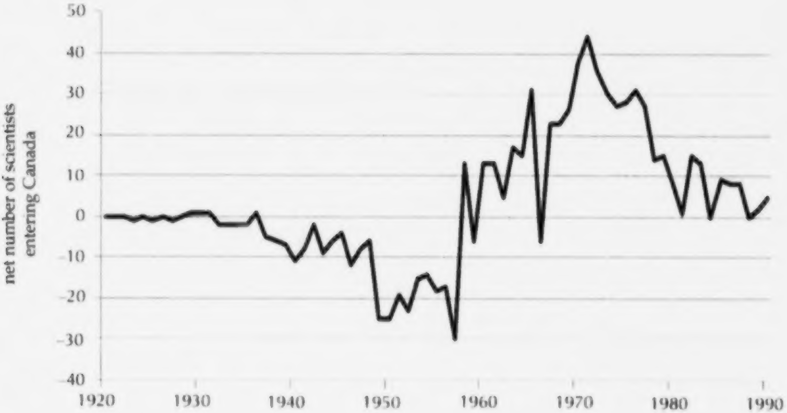
Source: Sample drawn from Hallard 1998.

an inverted U-shape, where the drain peaks before the gain. What we see now is not a decrease in the number of Canadian scientists but a falling off of both the gain and the drain.

The net flow of scientists from the United States into Canada — that is, the brain gain less the brain drain — is visible in Figure 2. Again, as in Figure 1, the loss of scientists in the early decades of the twentieth century is evident, followed by a considerable gain beginning in the 1950s, then a gradual falling off of the brain gain since the 1970s.

One must treat these observations with caution, since the sample is composed of "distinguished" scientists, as defined by the listing from which it is taken. It takes time to establish a reputation — the sample seems to suggest a period of about 20 years — which would explain the small absolute numbers at the tail end of the 1980s. What is true, however, is that the difference between gains and losses has been shrinking both absolutely and relatively in recent decades. Thus, from the point of view of the public concern about a brain drain over the past few years, what we may be seeing is a gradual falling off of the large number of immigrant scientists

Figure 2: ***The Net Gain of Scientists to Canada, 1923–90***



Source: Sample drawn from Hallard 1998.

as well as an outflow of Canadian-born scientists, as will be evident in the analysis below.

The Approach

In this analysis, I first ask the question, what characteristics of the scientists in the sample drawn from AMWS led them to choose to work in Canada rather than in the United States? This is an important question since it adds to the evidence of the existence of the "brain drain," albeit tempered by the admonition of Grubel and Scott (1977) that many additional issues are to be confronted before the welfare consequences are meaningful.

The way in which I approached the question was to ask whether the decision to work in Canada was affected by such variables as whether the scientist was born in Canada, whether the scientist is male or female, whether the scientist's studies were undertaken in Canada and what degrees the scientist received, the number of scientists in the sample who graduated in the same year, and their field of study.

A summary of the results of the analysis for selected variables is presented in Table 2, which shows the percentage change in the likelihood that a scientist in the AMWS sample is working in Canada, depending on which variable one looks at. For example, if the scientist has a medical degree, he or she is, all else being equal, 6 percent less likely to take a job in Canada. Similarly, if the scientist's last degree was obtained from a Canadian university, he or she is 25 percent *more* likely to be working in Canada.[6]

Analysis of the Results

The Effect of Being Canadian-Born

What effect does being Canadian-born have on the likelihood that a scientist in the AMWS sample is working in Canada? Do distinguished Canadian scientists flee the embrace of their native land once they have received their education or do they remain at home? How mobile have such scientists been over the past 60 or so years?

Although Canada is a nation of immigrants, one would expect, other things being equal, that a person who was born and raised in

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[6] In technical terms, this is an example of a probit analysis of the scientist's current working location. A probit analysis is a statistical procedure that provides a way to estimate a relationship between independent variables (such as whether the scientist was born in Canada, or the scientist's sex) and a dependent variable (such as whether the scientists works in Canada). In this example, the dependent variable takes the value of 1 if the scientist currently works in Canada (or has an address in Canada) and zero otherwise. In the case of the scientist with a medical degree, the coefficient on the variable is statistically significant at the 5 percent level. In contrast, the coefficient on a scientist's having a PhD is not statistically different from zero at either the 5 or 10 percent confidence level.

The reader with an interest in the technical aspects of the analysis will appreciate that the impact of the variable on the probability is the function $dp = \beta.f(X\beta)$, where f is the probability density function evaluated at some level of the independent variables X. One cannot simply read the coefficient in Table 2 and be confident of the impact on the probabilities. What one can tell from the table is whether the coefficient is statistically significant. Whether it is *economically* significant is the point of the subsequent discussion in the text. For a discussion of the full probit equation, see the technical appendix.

Table 2: ***Factors Affecting the Employment of a Scientist in Canada***

Variable	**Coefficient: Change in the Likelihood that a Scientist Is Working in Canada**
	(percent)
Born in Canada	15
Sex is female	4
First degree obtained from a Canadian university	22
Last degree obtained from a Canadian university	25
Size of graduating class	0
Holds a PhD	-2
Holds a medical degree	-6
Date of last degree	1
Date of last degree^2	0.01
University graduated from	
McGill University	-13
Université de Montréal	15
University of Ottawa	-16
University of Toronto	-5
University of Alberta	-6
University of British Columbia	-5
Université Laval	17
University of Manitoba	-8
University of Waterloo	-11
Field of specialization	
Chemistry	-6
Physics	-9
Agronomy	17
Animal research	12
Earth sciences and geology	8
Medicine	-8
Electrical engineering	-8

this country would be more likely to remain here to work than would a person born elsewhere. In fact, since restrictions have often been placed over the years on immigration to Canada, the observation that Canadians are more likely to work in Canada is an amalgam of both a natural preference to work in the country to which one is accustomed and the inability of people from other countries to come here freely to work.

On average, being Canadian-born raises the probability that a scientist in the sample is working in Canada by about 15 percentage points. That is, the likelihood that a scientist decides to remain in Canada to work is, other things being equal, only 15 percentage points higher for a native-born Canadian than for a scientist born elsewhere who is either working in Canada or has been trained here. Indeed, the effect of being Canadian-born on the likelihood that a scientist is working in Canada is not as significant as one might have expected. It is important to remember, however, that all the scientists in the sample have some kind of Canadian connection, whether they were born, are working, or were trained in Canada. It appears that Canadian scientists, while they may love their mother country, are clearly willing to move to the United States. Birth alone does not govern the work location decision.

The Effect of Sex

Although the data in the sample are relatively crude by labour economists' standards, female scientists are 4 percent more likely to remain in Canada than their male counterparts. This does not seem to be a large difference on the face of it, considering that, according to the 1996 US census, there were twice as many Canadian-born women as Canadian-born men in the general US population.

The Effect of Receiving the First Degree in Canada

As suggested above, the raw calculation of the effect of birth location is misleading. The effect of being born in Canada on the probability that a scientist works in Canada is not, in any case, very interesting. What is more interesting is the likelihood that a Canadian-born scientist who works in Canada also received his or her first university degree in this country. As Table 3 shows, in the sample drawn from the AMWS, 98 percent of Canadian-born scientists received their early university education in Canada. In contrast, of those who are not Canadian born and are working in Canada, about 51 percent received their first degree in Canada.

Table 3: ***Canadian Scientists and First Degrees Received from Canadian Universities***

	First Degree from Canadian University		
	Yes	**No**	**Total**
Born in Canada			
Yes	3,998	76	4,074
No	1,441	1,373	2,814
Total	5,439	1,449	6,888

Source: Sample drawn from Halland 1998.

How does all this affect where a scientist works? Recall that, holding all else equal, being Canadian-born raised the probability that a scientist was working in Canada by about 15 percentage points, which, I remarked, seemed low. All else is not necessarily held equal, however. A scientist who obtains his or her first degree in Canada is 21 percent more likely to remain in Canada than if the degree is taken elsewhere. Moreover, a scientist who was both born in Canada and received his or her first degree in Canada is a substantial 36 percent more likely to be working in Canada.

The Effect of Receiving the Last Degree in Canada

The distinguished scientists in the sample tend, of course, not to obtain just a single degree. Accordingly, a scientist who obtains his or her last degree from a Canadian university is 25 percent more likely to work in Canada, all else being equal. In summary, a scientist's being born educated with multiple degrees in Canada increases the likelihood that he or she will choose to work in Canada by a substantial 60 percent.

The Effect of the Size of the Graduating Class

Another variable to look at is the number of scientists who received their degree in each year of the sample period, since the size of the graduating class may have an effect on the probability that a scholar will find work in Canada. In fact, however, the impact of this variable is negligible, amounting to an increase of less than three one-thousandths of a percent.

The Effect of Specific Universities and Professions

Although there is no particular reason that specific universities and professions should be associated with working in Canada rather than in the United States, there is little doubt that some universities and professions are more likely to generate interest from abroad.

The scientists with Canadian connections in the AMWS sample graduated from more than 50 Canadian universities. In most cases, there appears to be no statistical correlation between a scientist's graduating from a particular university and working in Canada or the United States — for many of the smaller institutions, this could be the result of too few observations. For the nine universities listed in Table 2, however, such a correlation exists, all else being equal.[7] In seven cases, graduates were somewhat less likely to be working in Canada — 16 percent less likely in the case of University of Ottawa graduates. In the cases of Université Laval and Université de Montréal, however, graduates were 17 percent and 15 percent, respectively, more likely to be working in Canada; one reasonable hypothesis is that this reflects the preference and opportunity costs for graduates of these institutions to work in a French-speaking environment.

Different professions have their own imperatives, presumably arising from both pushes away from Canada or pulls from the United States. Table 2 shows that, for chemistry, physics, medicine, and electrical engineering, the United States has a distinctly positive lure, while in agronomy, animal sciences, and earth science and geology, there is a somewhat greater likelihood that a scientist is working in Canada. In the other 11 fields of specialization into which I classified the scientists in the sample, scientists displayed no inclination one way or the other toward working in Canada rather than the United States.

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[7] In this context, the idea of statistical significance means (roughly) that the coefficient is likely to differ from zero 95 times out of 100.

Back to the Future: The Tendency to Remain in Canada

The tendency for Canadians to remain in Canada is an important factor in determining whether there is a brain drain of the best and brightest to the United States. Accordingly, I examined the extent to which Canadian scientists remain in Canada as a function of the date at which they received their last degree. This has the effect of ordering the sample so that, as people get degrees at later and later calendar dates, one can discover whether they are more or less likely to remain in Canada. All other things being equal, do scientists who have received their degrees in the recent past tend to remain in Canada or leave more commonly than did earlier generations of scientists?

To undertake this analysis, I restricted the AMWS sample to those 4,103 scientists who were actually born in Canada (see Appendix Tables A-3 and A-4). What emerges from the analysis is that this relationship has changed over time, as Figure 3 shows. Until 1977, the probability of a scientist's remaining in Canada increased (although at a diminishing rate) with the recentness of the degree, all other things being equal.[8] In the figure, this point is the minimum of the trough, at 26.4 percent; by 2001, the probability increases by more than 10 percentage points, to 36.7 percent. If one were to look for an analogous period, one would have to go back to the immediate postwar period to find a time when a Canadian scientist armed with his or her final degree was as likely to work in Canada as is currently the case — with, of course, the ever-present caveat,

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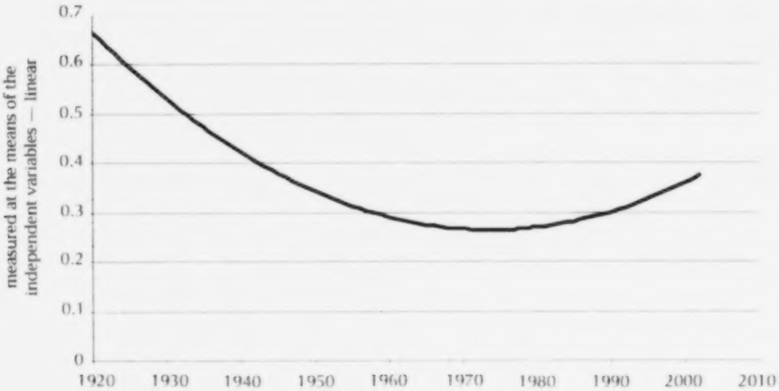
[8] Had I applied the analysis to all 6,888 scientists with a Canadian connection in the sample, the probability of remaining in Canada would have peaked in 1985. This is, however, a statistical artifact. Run separately on those who were not born in Canada, there is no tendency for those not born to leave with any greater or lesser frequency throughout the period.

Figure 3: ***Probability that a Canadian Scientist Will Work in the United States, 1920–2002***
(linear probability model)



Source: Sample drawn from Hallard 1998.

all else being equal. It is a gentle irony that, a decade after Americans were coming to Canada to avoid the Vietnam War and the draft, Canadian-born scientists who had finished their degrees appear to have been less likely than their predecessors to work in Canada.[9]

Concluding Remarks

Canadian scientists are an important group that embodies a considerable amount of human capital. The tendency of such people to leave Canada is linked not only to basic variables such as birth and education but also to the university from which they graduated and their field of specialization. From the analysis emerges a strong sense of a systematic southward movement of Canadian scientists. Are too many Canadian scientists moving to the United States? Clearly, this paper does not answer that question. Rather, what I have highlighted are some of the characteristics that are associated with scientists and their decision to locate in Canada. It appears, however, that Canadian-born scientists increasingly are moving to the United States, with a likelihood that is roughly double today what it was at the peak of Canadian retention in 1967. The evidence thus seems to suggest that, in that sense, we are going "back to the future."

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[9] The language here is deliberately delicate simply because we now have data on where scientists report themselves working, whereas in, say, 1977, we did not have such data. Consequently, a more correct, although cumbersome, statement of the relationship is that scientists who received their last degree after 1977 are less likely to work currently in Canada than their counterparts whose last degrees were in 1977.

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Technical Appendix:

A Probit Analysis Linking the Probability of Working in Canada to Attributes of Scientists Born, Working, or Educated in Canada

Table A-1: ***Scientists Working in Canada, A Probit Analysis***

Variable *(1)*	Coefficient *(2)*	Standard Error *(3)*	z-Statistic *(4)*	Probability *(5)*
Constant	-2.192076	0.412472	-5.314487	0.0000
Born in Canada	0.445724	0.040145	11.10274	0.0000
Sex is female	0.124457	0.056707	2.194749	0.0282
Size of graduating class	0.000932	0.000263	3.539998	0.0004
First degree obtained from a Canadian university	0.642695	0.055575	11.56436	0.0000
Last degree obtained from a Canadian university	0.746570	0.035951	20.76616	0.0000
Holds a PhD	-0.055010	0.035174	-1.563949	0.1178
Holds a medical degree	-0.190724	0.063116	-3.021814	0.0025
Date of last degree	0.033001	0.013908	2.372731	0.0177
Date of last degree^2	-0.000194	0.000109	-1.776066	0.0757
Field of specialization				
Chemistry	-0.198355	0.038763	-5.117090	0.0000
Physics	-0.281167	0.047435	-5.927455	0.0000
Agronomy	0.608518	0.126611	4.806187	0.0000
Animal sciences	0.380992	0.142364	2.676190	0.0074
Earth sciences and geology	0.247952	0.062305	3.979672	0.0001
Medicine	-0.248500	0.049237	-5.046988	0.0000
Electrical engineering	-0.239131	0.083398	-2.867351	0.0041
University graduated from				
U12	-0.370015	0.058991	-6.272456	0.0000
U15	0.626272	0.134176	4.667544	0.0000
U18	-0.445562	0.155626	-2.863033	0.0042
U31	-0.160622	0.053750	-2.988342	0.0028
U33	-0.178895	0.071129	-2.515075	0.0119
U34	-0.160915	0.063409	-2.537718	0.0112
U37	0.864066	0.177220	4.875664	0.0000
U38	-0.976149	0.519609	-1.878622	0.0603
U39	-0.241720	0.072633	-3.327942	0.0009
U47	-0.346300	0.147170	-2.353065	0.0186

Table A-1 - cont'd.

Mean dependent variable	0.621729	Standard deviation of dependent variable	0.484990
Standard error of regression	0.449228	Akaike information criterion	1.178228
Sum squared residual	1413.648	Schwarz criterion	1.204561
Log likelihood	-4115.650	Hannan-Quinn criterion	1.187300
Restricted log likelihood	-4663.701	Average log likelihood	-0.585274
Likelihood ratio (LR) statistic		McFadden R^2	0.117514
(26 degrees of freedom)	1096.103	Probability (LR statistic)	0.000000

Observations with dependent variable = 0	2,660	Total observations	7,032
Observations with dependent variable = 1	4,372		

Note: The dependent variable, working in Canada, is coded as 1 if the scientist works in Canada, 0 otherwise. Column 1 gives the variable names, column 2 the actual coefficient, column 3 the standard error of the coefficient, and column 4 the z-statistic — that is, the ratio of column 2 to column 3. Column 5 reports the probability that the coefficient is indistinguishable from zero on the basis of the normal distribution. A 0.05 or 0.10 in column 5 means that the coefficient is distinguishable from zero at the 5 or 10 percent confidence level.

Table A-2: *Scientists Working in Canada, A Least-Squares Regression Analysis*

Variable *(1)*	Coefficient *(2)*	Standard Error *(3)*	t-Statistic *(4)*	Probability *(5)*
Constant	-0.265159	0.141498	-1.873937	0.0610
Born in Canada	0.042681	0.019200	2.222948	0.0263
Sex is female	0.150848	0.013578	11.11013	0.0000
Size of graduating class	0.000312	8.87E-05	3.523485	0.0004
First degree obtained from a Canadian university	0.221237	0.018784	11.77811	0.0000
Last degree obtained from a Canadian university	0.251032	0.011733	21.39501	0.0000
Holds a PhD	-0.017901	0.011768	-1.521188	0.1283
Holds a medical degree	-0.062943	0.021316	-2.952865	0.0032
Date of last degree	0.011971	0.004774	2.507611	0.0122
Date of last degree^2	-7.23E-05	3.73E-05	-1.935543	0.0530
Field of specialization				
Chemistry	-0.064755	0.012914	-5.014266	0.0000
Physics	-0.088732	0.014966	-5.928887	0.0000
Agronomy	0.174639	0.036443	4.792049	0.0000
Animal sciences	0.124197	0.044931	2.764183	0.0057
Earth sciences and geology	0.079791	0.020192	3.951576	0.0001
Medicine	-0.081297	0.016606	-4.895498	0.0000
Electrical engineering	-0.077521	0.028363	-2.733173	0.0063
University graduated from				
U12	-0.126955	0.019989	-6.351092	0.0000
U15	0.147395	0.035474	4.154977	0.0000
U18	-0.156020	0.052339	-2.980927	0.0029
U31	-0.051649	0.017843	-2.894646	0.0038
U33	-0.059585	0.023905	-2.492530	0.0127
U34	-0.053360	0.021306	-2.504470	0.0123
U37	0.170125	0.040215	4.230440	0.0000
U39	-0.079694	0.024448	-3.259712	0.0011
U47	-0.109406	0.049355	-2.216708	0.0267

R^2	0.621729	Mean dependent variable	0.621729
Adjusted R^2	0.139032	Standard deviation of dependent variable	0.484990
Standard error of regression	0.450014	Akaike information criterion	1.244757
Sum squared residual	1418.603	Schwarz criterion	1.271090
Log likelihood	-4349.567	F-statistic	44.66895
Durbin-Watson statistic	1.955016	Probability (F-statistic)	0.000000

Note: The total number of observations is 7,032. Column 1 gives the variable names, column 2 the actual coefficient, column 3 the standard error of the coefficient, and column 4 the t-statistic — that is, the ratio of column 2 to column 3. Column 5 reports the probability that the coefficient is indistinguishable from zero on the basis of the normal distribution. A 0.05 or 0.10 in column 5 means that the coefficient is distinguishable from zero at the 5 or 10 percent confidence level.

Table A-3: *Canadian-Born Scientists, A Binary Probit Analysis*

Variable *(1)*	Coefficient *(2)*	Standard Error *(3)*	z-Statistic *(4)*	Probability *(5)*
Constant	-1.930517	0.599827	-3.218459	0.0013
Sex is female	0.211033	0.087366	2.415507	0.0157
Size of graduating class	0.000769	0.000362	2.123802	0.0337
First degree obtained from a Canadian university	0.263667	0.160355	1.644270	0.1001
Last degree obtained from a Canadian university	0.679468	0.045873	14.81182	0.0000
Holds a PhD	-0.083550	0.049317	-1.694136	0.0902
Holds a medical degree	-0.202596	0.088933	-2.278070	0.0227
Date of last degree	0.051770	0.019870	2.605450	0.0092
Date of last degree^2	-0.000337	0.000157	-2.143650	0.0321
Field of specialization				
Chemistry	-0.239474	0.052749	-4.539859	0.0000
Physics	-0.346697	0.062906	-5.511349	0.0000
Agronomy	0.420088	0.153339	2.739594	0.0062
Animal sciences	0.239851	0.177496	1.351309	0.1766
Earth sciences and geology	0.357677	0.087431	4.090955	0.0000
Medicine	-0.327846	0.070936	-4.621699	0.0000
Electrical engineering	-0.249702	0.117637	-2.122640	0.0338
University graduated from				
U12	-0.335343	0.074410	-4.506667	0.0000
U15	0.765381	0.163772	4.673453	0.0000
U18	0.145374	0.262286	0.554259	0.5794
U31	-0.150877	0.063863	-2.362501	0.0182
U33	-0.198902	0.079815	-2.492041	0.0127
U34	-0.230749	0.074399	-3.101508	0.0019
U37	0.855652	0.195487	4.377015	0.0000
U38	-0.186758	0.767120	-0.243454	0.8077
U39	-0.273780	0.081011	-3.379545	0.0007
U47	-0.474317	0.176952	-2.680483	0.0074

Mean dependent variable	0.703144	Standard deviation of dependent variable	0.456928
Standard error of regression	0.430632	Akaike information criterion	1.106525
Sum squared residual	756.0556	Schwarz criterion	1.146571
Log likelihood	-2244.036	Hannan-Quinn criterion	1.120702
Restricted log likelihood	-2495.349	Average log likelihood	-0.546926
Likelihood ratio (LR) statistic (25 degrees of freedom)	502.6259	McFadden R^2	0.100713
		Probability (LR statistic)	0.000000

Observations with dependent variable = 0	1,218	Total observations	4,103
Observations with dependent variable = 1	2,885		

Note: See Table A-1.

Table A-4: *Canadian-Born Scientists, A Least-Squares Regression Analysis*

Variable *(1)*	**Coefficient** *(2)*	**Standard Error** *(3)*	**t-Statistic** *(4)*	**Probability** *(5)*
Constant	-0.213899	0.203362	-1.051814	0.2929
Sex is female	0.068873	0.027536	2.501161	0.0124
Size of graduating class	0.000223	0.000117	1.901548	0.0573
First degree obtained from a Canadian university	0.075190	0.050794	1.480285	0.1389
Last degree obtained from a Canadian university	0.215059	0.014129	15.22104	0.0000
Holds a PhD	-0.026083	0.015280	-1.707058	0.0879
Holds a medical degree	-0.061841	0.028210	-2.192218	0.0284
Date of last degree	0.020515	0.006745	3.041568	0.0024
Date of last degree^2	-0.000139	5.30E-05	-2.617806	0.0089
Field of specialization				
Chemistry	-0.071091	0.016292	-4.363599	0.0000
Physics	-0.098349	0.017827	-5.516895	0.0000
Agronomy	0.116368	0.042205	2.757188	0.0059
Animal sciences	0.078614	0.052770	1.489738	0.1364
Earth sciences and geology	0.103649	0.025143	4.122385	0.0000
Medicine	-0.099753	0.022383	-4.456694	0.0000
Electrical engineering	-0.073273	0.037630	-1.947207	0.0516
University graduated from				
U12	-0.110025	0.024108	-4.563873	0.0000
U15	0.165520	0.038022	4.353269	0.0000
U18	0.040788	0.075248	0.542042	0.5878
U31	-0.046022	0.020063	-2.293870	0.0218
U33	-0.065696	0.025529	-2.573378	0.0101
U34	-0.075054	0.023892	-3.141466	0.0017
U37	0.164124	0.041401	3.964273	0.0001
U38	-0.074828	0.216985	-0.344854	0.7302
U39	-0.089778	0.026020	-3.450405	0.0006
U47	-0.144836	0.056767	-2.551393	0.0108

R^2	0.112374	Mean dependent variable	0.703144
Adjusted R^2	0.106931	Standard deviation of dependent variable	0.456928
Standard error of regression	0.431808	Akaike information criterion	1.164644
Sum squared residual	760.1889	Schwarz criterion	1.204689
Log likelihood	-2363.267	F-statistic	20.64606
Durbin-Watson statistic	1.865682	Probability (F-statistic)	0.000000

Note: See Table A-2.

Where Canadian Economists Work

Stephen T. Easton

The current debate about the "brain drain" is motivated by concern that an exodus of Canada's "best and brightest" to the United States will have deleterious consequences, not just for the quality of work produced by those who remain in the fields most affected, but for the performance of the Canadian economy as a whole.

Economists represent a highly trained and internationally mobile segment of the Canadian labour force that may be useful to study to discern whether their work location decisions amount, in effect, to a brain drain. (One might note, in passing, that two Canadian-born Nobel laureates in economics, Myron Scholes and Robert Mundell, both work in the United States.) Moreover, this particular profession within the social sciences was the subject of an intensive examination by Grubel and Scott (1977), which now provides a reference for comparison and a wealth of issues to engage.

In examining flows of Canadian economists to the United States, the place to start is with the list of the more than 17,000 members of the American Economics Association (AEA).[1] That list provides

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[1] I thank the American Economics Association for kindly making available its membership list in machine-readable format.

Table 1: ***Economists in the Sample***

	Canadian Training		
	No	**Yes**	**Total**
Born in Canada			
No	7,943	481	8,424
Yes	30	126	156
Total	7,973	607	8,580

Source: Sample drawn from American Economics Association membership list.

data on the economist's current address, birth date, degrees, and the dates on which the degrees were awarded, but not the economist's sex or salary. In many cases, the economist's citizenship and country of birth are also given. From the list, I extracted a sample numbering 8,580 for whom complete information was available. Of these, 156 report themselves as being Canadian-born[2] and 607 report having received some of their training in Canada (see Table 1).

The average birth date of economists in the sample of more than 8,000 for whom complete data are available is between 1944 and 1945, and the median year is 1945. No economists in the sample were born after 1973 and none before 1901.

The Characteristics of Economists Who Work in Canada

What leads an economist to choose to work in Canada? Or, from the perspective of the brain drain, what characteristics are consistent with an economist's choosing to leave? Table 2 indicates some the variables and the impact each has on the likelihood that an economist is working in Canada.

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[2] The rest are either not Canadian-born or their country of birth is not listed. In compiling its membership list, the AEA merely asks whether or not the member was born in the United States, but does not require foreign-born members to indicate either their country of origin or citizenship, and many do not do so. Accordingly, this factor is ignored in the subsequent analysis.

Table 2: ***Factors Affecting the Employment of an Economist in Canada***

Variable	Coefficient: Change in the Likelihood that an Economist Is Working in Canada
	(percent)
Born in Canada	0.29
Highest Canadian degree is a BA	13.0
Multiplied by the date of the economist's last degree	-0.01
Highest Canadian degree is an MA	25.2
Multiplied by the date of the economist's last degree	-0.01
Highest Canadian degree is a PhD	38.9
Multiplied by the date of the economist's last degree	-0.02
Log of the number of degrees granted in the US and Canada	-.006*
Number of degrees granted by Canadian universities each year	0.01
Number of degrees granted to Canadian-born economists each year	0.006
Date of last degree	-0.001
MA degrees granted outside Canada	0.00*
PhD degrees granted outside Canada	-0.01*

Note: All coefficients except those marked by an asterisk are significantly different from zero at the 5 percent confidence level.

The first and most obvious variable is being born in Canada. Although only a small fraction of the sample from the AEA list was born in Canada, all other things equal, being Canadian-born raises the probability that an economist is working in Canada by 29 percent.

Being born in Canada, however, is often tied to where the economist obtained his or her education. Table 2 shows the change in the likelihood that an economist is working in Canada if his or her highest degree obtained in Canada was a BA, MA, or PhD. The table also shows the interaction between that degree and the date at which the economist's last degree was obtained. The notion of interaction is important because it tells us the effect of a variable. For example, if an economist's highest degree is a BA, then the interaction that arises from the multiplication of that variable and the date of the last degree means that, for each date of the last degree, we can see the impact of having the BA. In other words, it allows the effect of the BA to be dependent on the date at which the degree was received. Thus, by interacting the degrees with their date of receipt, one can model the evolution of the likelihood of working in Canada as a simultaneous function of Canadian degree recipients and the date at which they received their degrees.

The relationship between degrees and whether or not an economist is working in Canada, shown in Figure 1, is a complicated one. It varies not only by degree but also by the date at which the degree was received. A value that lies above zero on the horizontal axis means that there is an increased probability that the degree holder is working in Canada, while a value below zero implies that the degree holder is less likely to be working in Canada. Thus, for an economist who received his or her Canadian degree in 1929, at the beginning of the study period, there is a strong likelihood that he or she is working in Canada. However, that probability falls steadily throughout the study period.[3] That is to say, for each degree and holding all other variables constant, it is less likely that the recipient is working in Canada today than at any point in the past, and there is now a distinct tendency for economists to work outside Canada once they get their Canadian degrees. It is important to emphasize, however, that this trend has been going on for more than 70 years and is not simply a response to recent events.

There is more to be said about the pattern of degrees. One can, for example, distinguish periods in which many degrees were granted from those in which relatively few were given. This is done through three different variables pertaining to the economists in the sample: the number of degrees granted in both the United States and Canada, the number of degrees granted to Canadian-born economists in each year, and the number of degrees granted in each year by Canadian universities.

Each of these variables illustrates a different tension in the market. The total number of degrees granted to economists is calculated by

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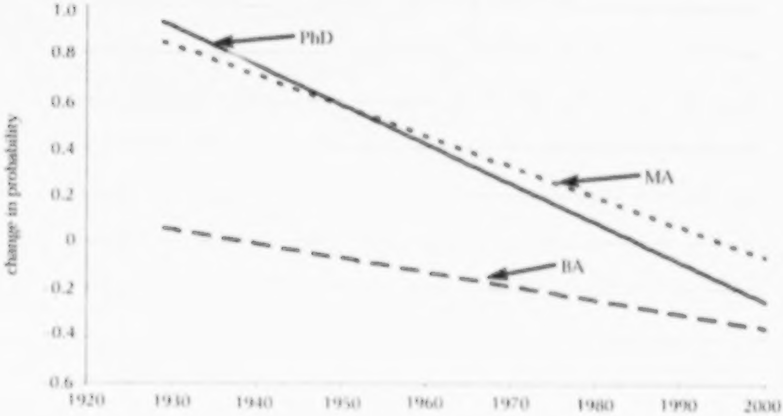
[3] The reader should remember that this sample is a cross section of economists rather than a true time series or a picture of individual economists year after year. As a result, when one speaks of things changing "over time," one really means that by a certain date within the cross section different effects are evident.

Figure 1: ***Change in the Likelihood that a Canadian Economist Is Working in Canada, by Degree, 1929–2000***



summing the number of degrees granted in each year. Since this includes all last degrees granted in a particular year without respect to the location of the granting institution, the variable is an effort to look at pressure on the international labour market, of which Canada is a small part and the United States is a large part. The coefficient on this variable is not significantly different from zero, which suggests that the world labour market for economists does not differentiate between the two countries.

The effect of the number of degrees among Canadian-born economists, however, does hint of at least a marginal effect of labour market pressure. The coefficient on this variable is negative, which suggests that, as more Canadian-born economists obtain their final degree (typically a PhD), the likelihood falls by a little over six-tenths of a percentage point that they will remain in Canada. To put this in perspective, since the largest group of Canadian-born graduates in the sample in any single year is 19, the effect lowers the likelihood that any economist in that cohort is working in Canada by 12 percentage points — as usual, with the caveat that all other variables are held constant. This is consistent with the observation that Canada is a relatively small market since, for much of the last half of the twentieth century, Canadian immigration regulations made it easier to hire Canadian-born economists than those born abroad.

The effect of getting a final degree at a Canadian university is to increase the probability that an economist will take a job in Canada by 0.8 percent. In addition, as the number of degrees taken in Canada increases, all else being equal, the number of economists taking jobs in Canada also increases. With as many as 50 graduates in recent years, the probability increases by about 40 percentage points that a graduate will take a Canadian job. Canada is training for a Canadian market.

Another variable is the date of the last degree taken, which has a straight negative effect on the number of economists working in Canada. That is, although the number of Canadian-trained economists has been increasing at roughly 3 percent per year throughout the last half-century, as time passes fewer remain in Canada.

The final two variables speak to the broader labour market and look at the impact of an increase in the number of non-Canadian-granted MAs and PhDs. In neither case is there a statistically significant association between the total number of degrees granted to economists outside of Canada and the number of economists working in Canada once the other influences that have been discussed above are taken into account.

Concluding Remarks

The use of data from the AEA permits one to chronicle the evolution of the employment of Canadian economists and those who receive their training in Canada. Among economists currently working in Canada, there is considerable concern that the United States is drawing away many of the best and the brightest. Casual observation among my colleagues points to an accelerated flow of many of Canada's more productive scholars out of the country — observation that, in fact, is corroborated by the aggregate data.

Although the evidence is compelling, it is only part of the puzzle of human capital mobility in Canada. Grubel and Scott (1977) found evidence that, despite the many Canadian economists working in the United States at the time of their study, Canada had experienced, by virtue of training and location, a net gain during the early 1960s. Although the evidence presented here does not deny that possibility, it is nevertheless the case that Canadian economists increasingly tend to take their degrees and work abroad. Perhaps this simply reflects the increased mobility of the profession, and perhaps it is a source of concern. The net effect of increased mobility depends crucially on the incentives available to scholars. If mobility between Canada and the United States is increasingly easy, then the extent of the resources Canadians should invest in higher education and how much we pay those who are so educated surely should be influenced by where our scholars work in the future. How many of our "own" we choose to keep at home is an important policy issue that has spanned at least the last two centuries.

Reference

Grubel, Herbert G., and Anthony Scott. 1977. *The Brain Drain: Determinants, Measurement and Welfare Effects*. Waterloo, Ont.: Wilfrid Laurier University Press.

Canadian Students in the United States

William Gibson

Approximately 23,000 Canadians currently study in US universities and colleges. Relative to the populations of foreign students in other countries, this is a huge number. How has it grown? Is it indicative of a rising gap in quality between universities in Canada and the United States, as some have suggested (see, for example, Handleman 1999)? Is a youth brain drain occurring? Canadian students sufficient to fill a medium-sized virtual Canadian university are voting with their feet. What are they voting for? Is their desire to study in the United States the first step in a permanent relocation to that country?

Young Canadians who seek admittance to a US university do so for two principal reasons. First, US universities might offer degree programs that are unavailable or of a quality unmatched in Canada — the equivalents of an engineering degree from Caltech or an economics doctorate from the University of Chicago do not exist in Canada. Second, a degree from a US university might expedite employment in and emigration to the United States. This is the brain drain phenomenon at work at the student level. Foreign students in the United States are allowed to work on or off campus in jobs closely related to their field of study. This could well be the most efficient way of finding permanent employment in the United States. A third, but less important, reason might be the desire of young Canadians to study abroad, although there is much more interest in studying at US universities than at universities in English-speaking countries overseas.

Weighed against the desire to attend US universities are the high costs of living and tuition relative to those for Canadian universities and the personal cost of separation from family. Indeed, Statistics Canada (Bélair and Frank 1999) has found that family ties are the main reason those who emigrate from Canada to the United States for employment return to Canada after some years.[1] Offsetting such costs to a certain extent, however, is the fact that top US universities offer scholarships that are substantially more lucrative than those in Canada. Moreover, many Canadians who enroll in US universities are superior students and likely to be receiving large sums of merit-based financial aid; for them, the cost differentials would not be as significant.

The Flow of Canadian Students to US Universities

Statistics on the enrollment of foreign students in Canadian and US universities in 1998, shown in Table 1, reveal a large outflow of students from Canada to the United States relative to flows to other countries and from most other countries to the United States. Remarkably, Canada sends six times as many students to the United States as it receives despite its having one-eleventh the population.

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[1] Formally, the migration function is

$$M = f(Q_{US} - Q_{CAN}, E_{US} - E_{CAN}, C_{US} - C_{CAN}, T_{US} - T_{CAN}, F),$$

where Q is quality and availability of programs of study, E is the value of employment possibilities, C is the cost of living (differences measured using purchasing power parity with financial aid subtracted), T is tuition fees less tuition scholarships, and F is some measure of family bonds that make study away from home difficult.

Table 1: ***Inflows and Outflows of University Students by Country of Origin, Canada and the United States, 1998***

	Outflow from Canada	**Inflow to Canada**		**Outflow from United States**	**Inflow to United States**
Australia	n.a	290	Australia	n.a	2,247
Belgium	98	106	Canada	3,742	22,747
Finland	28	102	Denmark	230	1,022
France	1,035	n.a	France	2,945	5,843
Germany	463	722	Germany	4,512	8,592
Greece	n.a	198	Greece	193	3,699
Italy	252	148	Italy	480	2,704
Japan	131	4,530	Japan	1,164	45,276
Mexico	n.a	783	Mexico	n.a	9,003
New Zealand	35	120	Norway	616	2,123
Norway	90	104	South Korea	328	33,599
Portugal	171	156	Spain	384	5,126
South Korea	47	1,360	Sweden	n.a	3,432
Spain	54	142	Switzerland	376	1,630
Sweden	n.a	232	Turkey	17	6,716
Switzerland	150	225	UK	6,243	7,786
Turkey	11	151			
UK	1,713	1,938			
United States	22,747	3,742			

n.a. - not available.

Source: Organisation for Economic Co-operation and Development.

Even for a country with a small population, Canada is a major supplier of foreign students to US universities and colleges. Despite significantly higher tuition fees, US universities and colleges evidently are seen as offering better value per outlay than Canadian universities by a large number of Canadian students.

Table 2 reports relative magnitudes of foreign and domestic students in Canada and the United States for selected academic years from the late 1970s to the end of the century. Of particular interest is that Canada has a higher percentage of foreign students in its universities than does the United States.

An examination of rates of growth of the enrollments shown in Table 2 reveals that the number of Canadians attending US universities and colleges has been growing significantly, at an average annual

Table 2: ***University Student Populations, Canada and the United States, various academic years 1977–78 to 1999–2000***

	University Students in the United States			University Students in Canada	
Academic Year	**Canadians**	**Other Foreigners**	**Americans**	**Foreigners**	**Canadians**
1977–78	12,600	235,544	11,050,243		374,000
1982–83	14,020	336,985	12,088,795	28,443	397,946
1987–88	15,690	356,190	12,410,452	27,119	458,890
1992–93	20,968	438,618	14,048,741	35,451	534,029
1997–98	22,051	481,280	13,864,136	35,556	537,543
1998–99	22,746	490,933			
1999–2000	23,544				

Note: Canadian statistics do not include students in community college transfer programs.

Sources: Statistics Canada 1997, 1998; Institute of International Education, various eds.

rate of about 3.5 percent (see Table 3). Moreover, that growth rate exceeds the growth of Canadians choosing to attend Canadian universities and even the number of Americans choosing to attend US universities, which barely changed between 1994 and 1999. Meanwhile, the number of Americans studying in Canada, though still relatively small, has surged by an annual average rate of 10 percent. The reason is not mysterious: controlled tuition fees in Canada are becoming lower relative to those for US public universities, an effect amplified at the end of the sample period by a weak Canadian dollar.[2] Nonetheless, many more Canadians than Americans cross the border to study, which suggests that, given the large tuition differential, for some Canadians the value of a US degree is extreme.

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[2] The relatively high rate of government subsidization of Canadian universities and their subsequently far lower tuitions make them a favourable choice for US students. The quality of larger Canadian universities is comparable to what Americans term their "flagship" state universities.

Table 3: ***Growth Rates of Canadian and US University Student Populations, 1975–98***

Source of Students in Host Country Universities	Annual Growth of Population
	(percent)
Canadians in US universities	3.6
Canadians in Canadian universities	2.3
Americans in US universities	1.3
Canadians in US universities less Canadians in Canadian universities	1.3
Canadians in US universities less Americans in US universities	2.2
Other foreigners in US universities	4.0
Canadians in US universities less other foreigners in US universities	insignificant

Note: Growth rates are author's calculations based on data in Table 2.

Of course, it is not just Canadians who are flocking to US universities and colleges. As Table 1 shows, students from other countries are also attracted in large numbers to the United States, which hosts three times as many foreign students as second-place France.

What Canadians Study in US Universities

I suggested above that one reason Canadians might be motivated to study in the United States is the quality of that country's universities. It is certainly true that the United States has most of the finest universities in the English-speaking world, but it also has many of the poorest. Do we know, in fact, that Canadians are being attracted to the best US universities? Could they not be going to the poorest, due to ease of entry, or to a wide range of institutions in terms of quality?

There is reason to think Canadians predominantly attend higher-quality universities, but the microdata are lacking to answer the question definitively. One can, however, examine what Canadian students are studying in US universities and, in so doing, form an impression of the students' motives and where they are going for their education.

Table 4: ***What Canadian Students Studied in US and Canadian Universities, 1998***

Undergraduates	**%**	**Graduates**	**%**	**All**	**%**
Popularity of Fields of Study for Canadians in US Universities					
Business	15.0	Health sciences	21.0	Health sciences	14.3
Other	14.3	Social sciences	13.7	Social sciences	13.6
Social sciences	13.9	Education	10.3	Business	12.8
Undeclared	12.5	Phys. & life sci.	9.7	Other	11.4
Health sciences	9.3	Business	9.7	Education	9.3
Education	8.0	Humanities	8.3	Phys. & life sci.	7.7
Fine & applied arts	7.1	Fine & applied arts	8.1	Undeclared	7.7
Phys. & life sci.	6.3	Other	7.9	Fine & applied arts	7.6
Engineering	5.2	Engineering	6.7	Engineering	5.8
Math. & comp. sci.	3.7	Math. & comp. sci.	2.3	Humanities	5.3
Humanities	3.2	Agriculture	1.5	Math. & comp. sci.	3.1
Agriculture	1.2	Undeclared	0.8	Agriculture	1.4
Popularity of Fields of Study for Canadians in Canadian Universities					
Social sciences	30.4	Social sciences	33.9	Social sciences	30.9
General arts & sci.	22.3	Education	15.2	General arts & sci.	19.8
Education	10.0	Humanities	12.6	Education	10.6
Humanities	8.9	Applied sciences	11.1	Humanities	9.4
Applied sciences	7.8	Health profession	9.0	Applied sciences	8.2
Ag. & biosciences	6.1	Math., physical sci.	8.2	Math., physical sci.	6.2
Math., physical sci.	5.9	Ag. & biosciences	6.3	Ag. & biosciences	6.1
Health profession	5.3	Fine & applied arts	2.0	Health profession	5.8
Fine & applied arts	3.3	General arts & sci.	1.6	Fine & applied arts	3.1

Note: For US universities, "health sciences" includes medicine, nursing, dentistry and associated fields. In Canadian universities, "social sciences" includes business, the single most popular major for undergraduates.

Sources: Institute of International Education; Statistics Canada.

Table 4 reveals what Canadians were studying in universities in the two countries in 1998 (although the fields of study are not defined in precisely the same way). It is interesting, for example, to note the popularity of business schools among Canadians studying in the United States — the choice of study of 15 percent of Canadian undergraduates. Since this field traditionally is not taught at the undergraduate level at elite US colleges and universities, one must conclude that most of these students attended middle- or even lowranked institutions.[3] Many of these students likely were interested in obtaining quickly marketable degrees and possibly intended to stay in the United States after graduation. Education was also a popular choice for Canadians in US universities. It is likely that many were working teachers who were studying part time or during the summer months to complete BEd and MEd degrees and who might have found US institutions more accommodating of part-time and summer students than their Canadian counterparts.

In 1998, 56 percent of Canadian nationals studying in the United States were undergraduates and a remarkable 44 percent were graduate students. By comparison, fewer than 15 percent of university students in Canada were graduate students. This disparity could reflect the desire on the part of Canadian graduate students to obtain the best possible education, which they might have regarded as being available in the United States. Moreover, increasing numbers of Canadian graduate students in the United States are to be found, not in the traditional academic disciplines, but in professional programs such as health sciences. Indeed, the striking popularity of health sciences among Canadians, both graduates and undergraduates, in US universities suggests that a brain drain is at work even among those yet to receive their professional school degrees and despite the substantially higher tuition fees in US institutions. Curiously, though, this does not seem to apply to engineering, another profession frequently cited in discussions of the brain drain. While a larger proportion of Canadian graduate students in the United States than in Canada were studying engineering in 1998, the reverse was true for undergraduates. At the same time, "engineering" is a catchall term for a diverse range of applied sciences that includes computer science, materials, and biotechnical engineering programs, which are particularly popular with Canadians but for which few disaggregated enrollment data are available. We do know, however, that foreign students make up more than half the enrollment of many US graduate engineering programs, and that a substantial percentage of these students intend to stay in the United States after graduation, suggesting that the brain drain into that country is a global phenomenon.[4]

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[3] Some of these students might actually have been pursuing business degrees at US universities that operate campuses in Canada — City University of Seattle has operated in Vancouver and DeVry in Calgary for more than 20 years — or that do not have physical campuses at all.

In summary, although data are lacking on the number of Canadians who return to Canada after obtaining degrees from US universities, it is likely that many Canadians choose to attend US universities because they intend to relocate in the United States after graduation, perhaps permanently. Moreover, although we also do not know which US universities Canadians are attending or, by extension, whether they are of high or low quality, there is every reason to believe that the value of a US degree, particularly one from a "good" school, reflects its use as a tool for Canadians who seek employment in the United States and in helping them to obtain the necessary visa. Finally, one should note that of the 28 largest US universities with "offshore" campuses, only one operates in Canada, which leads one to assume that the number of Canadians enrolled in such campuses is insignificant.

Emigration to the United States and University Education

Canada is not a major source of legal immigrants to the United States, ranking just fifteenth in 1995 with just under 13,000 immigrants.[5] Indeed, the flow of Canadian emigrants to the United States peaked in 1993 and has been falling ever since. At the same, time, as Table 2 showed, the flow of Canadian students to US universities has been steadily increasing. The issue of illegal immigration is another matter. The US Immigration and Naturalization Service estimates that 120,000 Canadians, or eight times the number of legal immigrants, moved to that country in 1996 (United States 1997). It is not known how many of the Canadians living and working in the United States without legal authority originally went there as students nor, of course, is it known how many foreign students work illegally while in that country.[6] There is, however, little question that working in the United States is an attractor for international students — student guide books devote considerable space to showing how a student visa can be used as a springboard to permanent residency, and such information is also available on Internet web sites.

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[4] According to the Institute of International Education (*Open Doors*, 2000 ed.), almost 100 percent of Chinese nationals completing PhDs in sciences and applied sciences want to remain in the United States upon graduation.

[5] In contrast, only 5,789 people emigrated to Canada from the United States in 1996.

US immigration policy roughly matches that of Canada in having two main categories of entry: the ability to make an economic contribution and the presence of close relatives already in the country. The first category favours the young, the experienced, the educated, and those with readily marketable abilities. Table 5 shows the age and sex distribution of legal immigrants admitted into the United States from Canada and the rest of the world in 1998. For the world as a whole, the flow peaks in the 25-to-29-year-old group while that from Canada peaks in the 30-to-34-year-old group. This holds true for both men and women. The slightly older maximum from Canada might reflect the fact that proportionally more Canadians finish formal education or obtain on-the-job experience before moving to the United States.

Table 6 shows that, for Canadians whose occupations are known, white-collar skills are preferred for entry into the United States both as legal immigrants and for subsequent citizenship. Table 7 reports that, of Canadian immigrants to the United States during the 1989–98 period, 49 percent were admitted on the basis of employability and 38 percent because they had spouses, parents, or children who were US citizens.

A Statistics Canada survey of graduates from Canadian universities who subsequently moved to the United States (Bélair and Frank 1999) supports the notion that many Canadians who attend US universities do so with plans to remain in that country after

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[6] Permissible work is typically confined to the campus and/or has direct relevance to the subjects the student is studying.

Table 5: ***Immigrants from Canada and Other Countries Admitted into the United States by Age and Sex, 1998***

	Total		Male		Female	
Age	All Countries	Canada	All Countries	Canada	All Countries	Canada
Total	660,477	10,190	299,946	4,968	353,426	5,164
Under 5	33,797	653	15,356	348	18,411	301
5 to 9	39,035	1,023	19,839	526	19,146	489
10 to 14	56,459	878	29,320	418	27,083	455
15 to 19	68,319	763	34,623	364	33,619	394
20 to 24	59,609	744	26,530	274	32,963	465
25 to 29	85,432	1,223	37,993	540	47,238	676
30 to 34	78,065	1,401	35,762	698	42,100	704
35 to 39	56,546	1,220	25,189	626	31,230	587
40 to 44	43,331	901	18,615	439	24,643	458
45 to 49	33,695	602	14,639	311	19,008	289
50 to 54	26,127	371	11,038	201	15,057	170
55 to 59	22,411	159	8,975	94	13,415	64
60 to 64	19,651	92	8,130	60	11,505	32
65 to 69	14,835	61	6,531	25	8,291	36
70 to 74	9,017	25	3,912	12	5,102	12
75 to 79	4,332	18	1,900	12	2,427	6
80 & over	2,533	17	1,010	5	1,520	11
unknown	7,283	30	584	15	668	15

Note: Most Canadians were admitted in California, Florida, and New York, popular states for both immigration application and foreign student enrollment for all nationalities.

Source: United States 2000.

graduation. Although only 4,600, or 1.5 percent, of the 300,000 graduates of Canadian universities in 1995 subsequently moved to the United States, they accounted for close to a third of all legal Canadian emigrants to the United States that year. Of graduates who moved, about 12 percent had PhDs and 20 percent held nursing degrees. Close to 36 percent of graduates who moved had received academic awards and scholarships as students, almost twice the Canadian average. Moreover, 44 percent reported that they had been in the top 10 percent of their class in their major field; another 36 percent had been in the top 25 percent of their class. As a group, then, these graduates were clearly above the norm. The main reasons they gave for moving were better job opportunities and higher

Table 6: ***Occupations of Canadians in the United States, Immigrants and Naturalized Citizens, 1998***

	Immigrants	**Naturalized Citizens**
	(percent)	
Professional/technical	12	14
Executive/administrative	11	11
Sales	1	5
Administrative support	2	9
Operator/labourer	2	6
Services	2	4
No occupation or not reported	70	49

Source: United States 2000.

Table 7: ***Canadians Legally Admitted into the United States, 1989–98***

	Immigrants	**Students**
1989	12,151	16,030
1990	16,812	17,000
1991	13,504	18,350
1992	15,205	19,190
1993	17,156	20,968
1994	16,068	22,655
1995	12,932	22,747
1996	15,825	23,005
1997	11,609	22,984
1998	10,190	22,051

Source: United States 2000.

salaries.[7] It is also interesting that, as Table 8 shows, the pattern of subject areas of the emigrants' degrees bears a close resemblance to those pursued by Canadian students enrolled in US universities. The similarities between these groups of Canadians south of the border suggest that many of those who choose study in the United States are among Canada's brighter academic talents and are probably attending highly regarded US universities.

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[7] Statistics Canada estimates a BSc holder would earn C$9,000 more in the United States in a similar position than in Canada.

Table 8: ***Fields of Canadian Immigrants and Students in the United States, 1997***

Field	Immigrants	Undergraduate Students	Graduate Students
Health sciences	20.0	9.3	21.0
Engineering	13.0	5.2	6.7
Social sciences	13.0	13.9	13.7
Mathematics & sciences	11.0	10.0	12.0

Sources: Institute of International Education; Statistics Canada.

Conclusions

Although the absence of information about individual students and the universities they attend makes definitive statements impossible, one can still form an impression of Canadian students in the United States that is beyond an "educated guess." In academic year 1993–94, 2,700 Canadian students left their home provinces to study in other provinces, a number dwarfed by the more than 20,000 who chose to study in the United States.

We know something in general about these students. They are not going to the poorer-quality universities and colleges in appreciable numbers. They are not studying at US institutions while actually residing in Canada. And, as with students from the rest of the world, students from Canada are going to US universities in increasing numbers. Indeed, the growth rate of Canadians enrolled in US universities significantly exceeds that of Canadians enrolling in universities at home.

We also know that the number of Canadian graduate students attending US universities is disproportionate to the number of undergraduates when compared with those studying in Canada. The emphasis that undergraduates have on more readily marketable subjects is exaggerated where graduates are concerned. A significant number are studying in the health sciences field, including medicine — a field often mentioned with respect to the brain drain phenomenon. Evidence suggests, however, that the brain drain in this field is not so much of physicians who are already practising in Canada as of young people moving south years before earning their professional and graduate degrees, despite the large and growing discrepancy between Canadian and US tuition rates.

A desire to gain admittance into the United States may reveal itself in the wish to earn a degree at a prominent, high-quality US university, as would the desire to study at a first-rate university for its own sake, although one cannot say that quality for its own sake is the most important motivator. At the same time, some suggest that Americans could save money by attending far less expensive Canadian universities, but relatively few do so, which leads one to wonder if a lack of international reputation is part of the reason.

Given the small size of the flow of students to the United States in both absolute and relative terms compared with the size of the Canadian population, one might argue that the case for a brain drain is overstated. Nevertheless, to continue the domestic plumbing metaphor, the flow of Canadian university students to the United States is like a leaking hot water faucet: it is difficult to get motivated to tend to it immediately, but there is the knowledge that, ignored, the accumulated loss will amount to something.

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Costing the Brain Drain

Richard G. Harris

This essay reviews alternative ways of looking at the costs and benefits of the migration of highly skilled labour. In other words, it looks at how economists go about "costing" the "brain drain" — since the perspective one takes of the underlying economics of the brain drain issue dramatically affects both how one might do the cost-benefit calculation and how one interprets the resulting numbers.

In Canada, the brain drain debate has focused on the movement of highly skilled individuals to the United States. The concern is that the departure of the "best and brightest" slows economic growth, reduces the capacity for Canadian innovation, retards the ability of knowledge to diffuse internationally across borders, and contributes to the perception abroad that Canada lacks sufficient incentives to keep its best people at home. At the same time, however, Canada tries hard to recruit skilled labour from developing countries.

This brain drain perspective leads to a conventional analysis that looks at the costs and benefits of the permanent transfer of human capital from one country to another, which, for lack of a better term, I refer to as the "migration approach." Within this framework, an important aspect of the analysis is the impact of the migration of skilled people on the international distribution of productivity growth and, thus, on long-term patterns of growth in different countries. This general type of analysis can be called the "national factor of production approach" to human capital, whereby one inherently identifies geographic locations with the residency and place of work of skilled individuals. Since migration, by definition, moves a factor of production — human capital — from one country to another, this approach to the brain drain issue has a considerable zero-sum aspect.

In contrast to the brain drain perspective is what might be called the "globalization" of the labour market for the highly skilled. From this point of view, recent movements of talent across international borders are part of a much broader phenomenon — they are not so much the transfer of human capital from one country to another as a manifestation of the increased mobility of certain types of services in the global economy. Scientists and engineers, for example, whether they work in universities or in private firms, can be thought of as part of a global labour force involved in global industries. The globalization perspective calls for a different approach to evaluating the welfare consequences of particular migrations and to the policy regime that governs labour mobility as a whole.

The essay proceeds as follows. In the next section, I review the standard welfare economics of migration that are derived from neoclassical international trade theory and discuss how one might interpret some of the recent evidence in light of that theory. I then go on to discuss dynamic factors related to human-capital-driven growth and knowledge spillovers, but within a standard migration framework. Next, I deal with the difficult issue of the quality of migrants — in particular, what has become known as the "superstar" phenomenon in labour markets. Finally, I look at the globalization of the market for the very highly skilled, again with a focus on human-capital-driven growth and knowledge spillovers.

The Neoclassical Approach: Shifts in Factor Supplies

Most of the literature on the brain drain relies on the neoclassical model of international trade and factor movements,[1] in which a small, open economy (such as Canada's) is unable to influence the prices of the goods it exports and imports.

The Welfare Effects of Labour Migration

Using this model, one can examine the effect on incomes and wages of a movement of labour from one country to another. The mode of analysis is largely static in nature: the examination of how the movement of labour affects output, prices, and welfare in both the host and source countries. What does this literature tell us about the Canadian brain drain (and gain)?

The static approach to the cost of the brain drain is depicted in Figure 1. Within this approach, the focus is the impact of the brain drain on the real incomes of different factors of production. Depending on the level of detail and data, one typical focus is a limited set of labour types distinguished by skill. In the simple model, one can distinguish between highly skilled labour (the "brains") and all other labour types. Migration is treated as a change in the supply of the numbers of a certain skill type. Changes in hours of work per person are ignored. In the case illustrated in Figure 1, there is a change in the supply of brains. For our purposes, it is useful to abstract from a number of issues, including the possibility that shifts in the supply of factors will affect prices (so-called terms-of-trade effects), the existence of distortions in the economy such as taxes or restraints on trade, and monopsony or monopoly power in either labour or goods markets.

Figure 1 shows an initial, inelastic supply of skilled labour, *OB*, earning wages *OF*. Gross domestic product (GDP) is given by area

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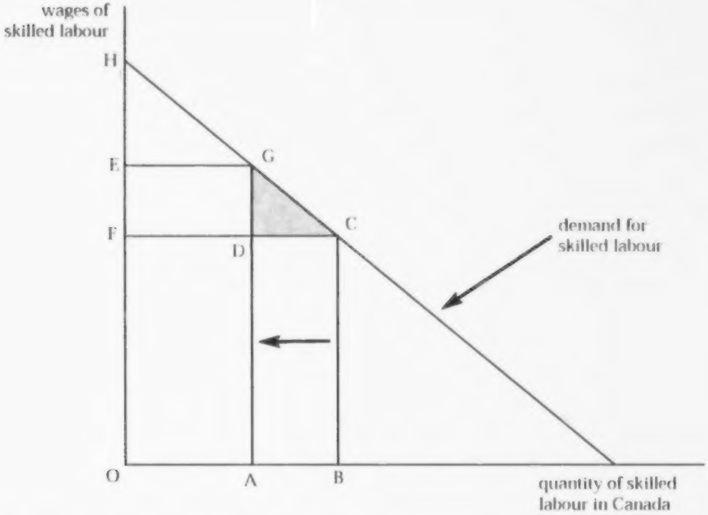
[1] Standard textbook discussions of this issue can be found in Markusen et al. (1995) and Caves, Frankel, and Jones (1999).

Figure 1: ***Static Cost of the Brain Drain and Distributive Effects***



OHCB, which is produced using skilled labour (brains) and immobile factors of production one can refer to as "unskilled labour." A net out-migration of brains (the "drain") amounting to *AB* occurs, which has a number of effects. First, GDP declines by the area *AGCB*, although part of this loss constitutes the wages of those who migrated. From a welfare perspective, it may be more appropriate to focus on the earnings of those who remain, rather than total GDP. For simplicity, therefore, assume there is no in-migration, so that the amount *AB* represents the total number of skilled workers who leave. The second effect is that the wages of the skilled workers who stay rise to *OE* and their total earnings increase by the area *FEGD*. Unskilled workers, however, are now less productive because they now have fewer skilled individuals to work with, and their income declines by the amount *FHC*. Subtracting the losses to unskilled labour from the gains to skilled labour that remains, one can determine the cost of the brain drain as area *DGC*.

If one assumes, however, that there is a net in-migration of brains, then the cost turns into a benefit. Looking again at Figure 1, if one assumes that the initial supply of brains is *OA* and that there is a net increase of *AB* in the supply of brains through in-migration, several effects occur. GDP as a whole increases by the area *AGCB*, the in-migrating brains earn wages *ADCB*, the increased supply of brains drives down the wages of existing brains from *OE* to *OF*, and other types of labour increase their income by amount *FHC*. The effect on domestic incomes is that the gains to unskilled labour exceed the losses to domestic brains by area *DGC*. Quantitatively, the labour economics literature puts the absolute value of the wage elasticity of demand for highly skilled labour, ε, between 0.5 and 1.5. If b denotes the fraction of the quantity of brains that in-migrates as a proportion of the initial number of brains, then a standard formula expressing the net welfare gains to an in-migration of brains is

$$\text{Net gain to migration as \% of total brain income} = \frac{1}{2\varepsilon}\, b^2.$$

For any realistic values of these parameters, these are extremely small numbers. For example, if $\varepsilon = 1$ and $b = 10$ percent (a very large migration), the net welfare gain would be 0.005, or one-half of 1 percent of brain income. Expressed as a percent of GDP, the magnitude is even smaller: since skilled labour accounts for about a third of national income, the number would then be one-third of one-half of 1 percent. In practice, because these numbers are so small, they are rarely reported; more commonly, the wage effects are reported instead. For example, the increase in GDP due to the in-migration of brains can be approximated much more simply by multiplying existing wages of brains by the number of in-migrants.

International trade economists are often critical of applying this approach to small, open economies such as Canada's because it assumes that changes in the supply of factors of production affect the wages of both brains and nonbrains — that is, highly skilled and unskilled workers. A substantial empirical and theoretical literature argues that, for countries such as Canada, wages and the prices of goods are determined in the long run largely by conditions of technology and international competition, and that domestic labour supply conditions have little effect on wages over the longer run — although they obviously can have an effect in the short run. Under this approach — which is often associated with the Hecksher-Ohlin model of trade and the associated factor price equalization theorem — the demand curve for brains becomes horizontal, or perfectly elastic, in the observed range. Small migrations in or out have no effect on the wages of either brains or nonbrains. Instead, they have large effects on *output* — for example, the standard trade model predicts that an in-migration of brains would expand those sectors of the economy that use brains intensively. Such quantity effects, however, are welfare neutral; they neither raise nor lower the welfare of any existing group in the economy.

In practice, although relatively few brain drain studies take the neoclassical factor supply approach, some modern general equilibrium studies, mostly focusing on Europe, use a basic elaboration of this method. These types of calculations are quite sensitive as to "who counts" in determining the national cost of the brain drain. It is fairly common, for example, to count as the relevant group the initial residents who remain in the home country after the outflow occurs. Now, looking at Figure 1 again, consider an extreme example in which the entire initial group of brains, *OA*, leaves and is replaced by the in-migration of skilled workers. In this instance, the welfare relevant group is all unskilled labour. Using this criterion, the cost of the brain drain net of immigration is the much larger quantity *FEGC*. In general, whether one should include the wages of the new immigrants in a national cost-benefit calculation is, at the end of the day, a value judgment.

Another difficulty is that some of these calculations do not have an internally consistent theory as to the numbers that migrate based on some more elaborate theory of migration. The standard approach to analyzing the brain drain presumes that the outflow is to a country that is able to attract skilled migrants successfully. In our case, the presumption is that highly skilled labour that leaves Canada for the United States is more highly paid south of the border, adjusted for purchasing power differences. Indeed, for professionals, the gap between US and Canadian before-tax earnings has widened substantially. Data constructed by Iqbal (1999) suggest that, as of 1997, US professionals earned, on average, about 40 percent more than their Canadian counterparts. Generally, this difference is ascribed to a growing increase in demand in the United States for these types of skills rather than to an increase in supply relative to demand in Canada.

In general, the neoclassical factor supply approach to migration suggests that, on quantitative grounds, the brain drain (or brain gain) is largely insignificant and that its effect on economic welfare ought to be small. Is this theory, therefore, irrelevant in addressing current Canadian policy concerns surrounding the brain drain? The answer is a qualified yes, but, as I argue later, such concerns are better addressed using alternate analytical perspectives. One should not discount this approach entirely, however, for one important reason. It may well be that, while the basic theory is correct, its empirical implementation has been too highly aggregative. It is possible that, in some critical professions, changes in supply could have a significant impact on the general level of wages and prices in the economy as a whole.

Suppose the economy's aggregate output can be described by a production function $F(...)$, which is a function of a number of types of labour, L, and one critical profession — the brains — whose supply is B. Total output therefore is

$$Y = F\ (L_1, \ldots\ldots, L_n, B).$$

Shifts in the quantity of B, holding the supply of other factors constant, depends critically on what is known as the "elasticity of factor substitution" between brains and other factor inputs. Although it is difficult to prove using conventional data sources, one could imagine some occupations where substitution is very low in the short to medium term. A classic example is medical specialists — only brain surgeons can perform brain surgery, so a reduction in the supply of brain surgeons would unambiguously reduce the number of brain surgeries, creating an obvious shortage. In a private medical system, such a shortage would drive up prices; in

Canada's publicly run system, the effect would be to lengthen waiting lists for surgery. Obviously, such quantitatively small reductions in supply would have important welfare consequences in this particular market. Normally, when sources of supply are reduced and substitutes are unavailable, there is a large price response; in the case of brain surgeons, their wages should rise rapidly and, to the extent the labour market works, the problem should be self correcting. When there are labour market rigidities, however, as in the case of the Canadian health care system, this response is muted and the welfare consequences are accordingly larger.

In some cases, these effects can also become significant at the aggregate level if two conditions occur. First, as discussed above, the elasticity of factor substitution must be low — that is, the highly skilled service cannot easily be replaced by some combination of other factors of supply. One cannot, for example, quickly train other medical specialists to become brain surgeons.

Second, and less likely, the output of the sector itself must be critical at the aggregate level. Aggregate output (or GDP) consists of literally thousands of different types of outputs produced in both market and nonmarket mechanisms. An unanticipated contraction in just one of these outputs is unlikely to have a large aggregate effect, but one can imagine circumstances in which this might occur — the failure of a telecommunications network, for example, or a contraction in energy supply or in transport services such as rail or airlines would have a large effect on GDP. Similarly, a drain of highly trained professionals — particularly in these types of infrastructure industries — is of serious concern to a small, highly open country. In Canada, the effect of such a drain is relatively much smaller due to the size of the country's economy. Nevertheless, this issue may become increasingly important as globalization pushes the specialization envelope to an ever-greater degree. If Canada were to start losing a significant share of an important class of engineers, for example, concerns might be warranted, but so far this possibility seems remote and, in most cases, the market would likely react appropriately to solve the problem.

Measuring the Costs of Human Capital Migration

An obvious problem with the static approach to determining the cost of the brain drain is that it ignores the costs incurred to create the human capital embodied in highly educated people who migrate to another country. Thus, much of the empirical work on the brain drain uses cost-based approaches that focus on the total resource costs of the human capital of those who leave; some studies arrive at a net cost figure by factoring in the human capital expenditures embodied in new immigrants.

One important issue with cost-based approaches is to determine what should count as a cost. Conventionally, only the direct costs of education are counted, but a more comprehensive approach would include the opportunity costs of the foregone output that those who emigrated would have produced had they worked in Canada instead of going to school. In Canada, most of the direct costs of education are public expenditures, but even if they were private one would still have to account properly for the social costs, as opposed to the private costs, of migrating, since, from the economy's perspective, the act of migrating still represents a net transfer of resources. As William Gibson notes in his essay in this book, many Canadians are choosing to obtain their university education abroad. If those foreign-educated Canadians do not return to Canada or subsequently leave this country, the total cost of that education represents a net transfer from remaining Canadian residents to nonresidents. DeVoretz and Laryea (1998) calculate that, in the 1990s, the cost (net of immigrant human capital inflows) of Canadians who emigrated to the United States was $11.8 billion.

Calculations such as those of DeVoretz and Laryea, however, have two debatable aspects. First, although the authors estimate that about 50,000 Canadian brains drained southward over the period they studied, it is extremely difficult to determine the actual number due to the limited nature of the available data. Second, one has to make assumptions about the cost of the counterbalancing human capital that is acquired through immigration, a number that is hard to pin down. Although most immigrants in recent years have come from developing countries, where education costs are much lower than in Canada, over the 1990–96 period Canada gained 32,829 university graduates annually through immigration while losing 8,512 annually to the United States (Zhao, Drew, and Murray 2000). Judging by Canada's large net gain of university graduates, therefore, one could conclude that the brain drain is not quantitatively significant.

Looking at the issue from the perspective of the total new supply of relevant occupational groups, the numbers are even less impressive. Table 1, using Statistics Canada estimates, shows that emigrants constitute a minor fraction of total supply in four important occupations, with the largest numbers in the well-known case of nurses. Admittedly, significant uncertainty exists about the accuracy of Canadian emigration estimates. In particular, there is considerable debate about the role of temporary US visas such as TN and H1B visas, the use of which grew dramatically in the 1990s. Iqbal (2000) notes that, by the end of 1997, 90,000 such visas had been allocated to professionals employed in the US economy and thus represent "brains" that had entered that country. Of these, Iqbal estimates that, adjusting the data for double counts and renewals, about 35,000 had been granted to Canadian professionals who had moved to the United States.

Dynamic Factors: Human Capital and Spillovers

Both the static and cost-based approaches to assessing the brain drain suggest that the problem is relatively minor. Yet the policy concern, as expressed by government and business and in media commentary on the issue, is considerable. From an economist's perspective, how does one go from small to large? Doing so essentially involves introducing dynamic considerations into what has otherwise been a static analysis. Migrations of the order of magnitude observed, if they are to matter, must affect long-run growth

Table 1: ***Canadian Emigrants to the United States in Selected Occupations Relative to New Supply, 1990–96***

	Movement to U.S.	New Canadian Labour Supply	Emigrants as a % of New Supply
Physicians and health diagnosing	360	7,000	5.1
Nurses	816	38,200	2.1
Engineers	527	28,600	1.8
Computer scientists	139	25,900	0.5
Managerial occupations	2,347	388,700	0.6

Sources: Drew, Murray, and Zhao 2000; author's calculations.

rates or, equivalently, productivity. What type of growth linkages might be of interest in this case?

The first route is through human capital spillovers that affect economic growth rates. The well-known human-capital-based model of Robert Lucas (1988) predicts that differences in growth rates are due to differences in the average level of human capital in an economy. Thus even small differences in human capital levels can lead to small differences in growth rates, but even small differences in growth rates over a long period carry enormous implications for living standards. By this account, the out-migration of highly skilled Canadians reduces the growth potential of the Canadian economy. Crucial to the Lucas framework is the concept of a spillover of the average level of human capital on overall productivity. Although empirical support for this is mixed, it does carry important consequences.

Suppose aggregate output is described by a two-factor production function in which GDP, denoted by Y, is produced with two inputs: physical capital, K, and human capital, H. H is given by $H = hL$, where h is the average level of human capital in the economy and L is the number of workers. Output is determined by a production function,

$$Y = h^{\delta} K^{\alpha} H^{1-\alpha} .$$

This is a fairly conventional Cobb-Douglas aggregate production function except that there is a spillover term of average human capital, denoted by h^{δ}. In the Lucas framework, growth in total factor productivity hinges directly on increases in h. Private and social returns to education and training are different and increasing in the spillover parameter δ.

Lucas's theory generates very large differences in both income levels and growth rates for small differences in policy variables. For the purposes of the brain drain issue, one important result from this model stands out. Imagine two economies, both in a state of long-run steady growth, that are identical in all respects except that they differ in their initial levels of individual human capital. In this case, the economy with the higher initial level of h will have a permanently higher level of income, with the income gap between the two economies proportional to their productivity gap and with both gaps proportional to the gap in their initial human capital. Lucas uses this example to explain why the income levels of countries with different levels of human capital might not converge even if their growth rates do.

Applied to the brain drain issue, the Lucas model has the straightforward implication that a one-time transfer of human capital from a poor to a rich country has the long-run effect of raising the income gap between the donor and host countries. There is also a transitional effect in which the growth rate of the donor country falls and that of the host country rises. Haque and Kim (1995), for example, note that the brain drain causes a feedback effect that increases the cost of human capital acquisition for those who remain, which then causes individuals to decrease the rate at which they acquire human capital, which, in turn, reduces the economy's rate of growth.

The Lucas framework has potentially important implications for the brain drain if one could show that the spillovers are important and that the observed human capital transfers are sufficient to have affected the average level of human capital in Canada. Unfortunately, although both effects are plausible at the aggregate level, they are unlikely to have had much effect on the brain drain, for two reasons.

First, as already discussed, the magnitude of human capital transfers is still fairly modest. Moreover, studies comparing human capital levels in Canada and the United States show that most of the changes in those levels over time can be explained by changes in the output of the education sectors and educational attainment rather than by migration. Murphy, Riddell, and Romer (1998), for example, point out that Canada's higher rate of growth of skilled labour during most of the 1980s and 1990s led to a convergence, rather than a divergence, in the human capital intensity of the Canadian and US economies.

Second, the importance of human capital spillovers is actually the subject of a substantial debate, and recent evidence suggests it is small (see Harris 2001). It is important to emphasize, however, that the view of the small importance of human capital for economic growth is based entirely on aggregate evidence and on human capital measures that refer to average educational attainment or years of schooling. If one takes the view that the human capital effect is much narrower and focused on the movement of a few critical people in selected areas, the importance of the effect for economic growth could be more significant, as I discuss below.

Another way an economist gets from small to large is via "knowledge spillovers." The literature on knowledge spillovers, between both industries and countries, grew out of the literature on knowledge-based endogenous growth. In the international context, a large empirical literature demonstrates that knowledge developed in one country spills over into growth in another country. The magnitudes of these spillovers are impressive, even though the studies that look at the issue have had to use proxies of one or another for "knowledge." One common knowledge indicator is the intensity of research and development (R&D). In one influential study, Coe and Helpman (1995) document the very large knowledge spillover effect from the United States to Canada. In an earlier paper, I make the following observation:

> The Coe-Helpman research distinguished between domestic R&D, global R&D and the role of trade. For Canada their results indicate that global R&D is more important than domestic R&D and that this variable interacts with trade, measured by the import share in facilitating knowledge transfers. To give an example, Bayoumi, Coe, and Helpman (1996), using the [International Monetary Fund] Multimod macroeconometric model and the Coe-Helpman spillover parameters, estimate the cumulative effect of permanently increasing the share of GDP devoted to R&D by ½ of a percent in selected countries and looking at the macroeconomic effects over a 75 year period. In the case of the US this would amount to about a 25 percent increase in R&D spending. Their simulations show this would have a 9 percent increase on US potential output and a 6.8 percent increase on Canadian output. From a welfare point of view consumption is the more relevant indicator and here the results are even stronger. US consumption rises by 6.9 percent while Canadian consumption rises by 6.8 percent. Increasing Canadian R&D expenditures by ½ of 1 percent increases Canadian consumption by 7 percent. The results clearly indicate that Canada is a major beneficiary of US innovation spillovers, although the dynamics of this process are not yet identified. (Harris 1996, 14.)

More recent work by, for example, Eaton and Kortum (1999) shows that, even in large countries, the international diffusion of technology is the major factor in productivity growth — they estimate that technology diffusion explains fully 87 percent of productivity growth in France. Keller (2001a, b) estimates that, between 1983 and 1995, the contribution of international technology diffusion, as opposed to domestic R&D, accounted for an increasing share of R&D-explained productivity growth in the Group-of-Five major industrial countries. For Canada, Keller calculates that knowledge spillovers account for 97 percent of the total effect of technology on productivity growth. In some cases, these spillovers appear to be related to trade in specific goods. Gera, Gu, and Lee (1999) estimate that technology spillovers embodied in information and communications technology (ICT) imports from the United

States have an effect on labour productivity in Canadian industries that is about four times greater than spillovers embodied in non-ICT imports.

The work of Keller and others on technology spillovers has raised the relative importance of global technological diffusion as an explanation of growth. This issue relates to the brain drain to the extent that specialized human capital might be an important conduit through which technological knowledge is diffused. Nelson and Phelps (1966) suggested many years ago that human capital is an important determinant of the successful transfer of technology. Although this effect has not yet been quantified, the presumption must be that it is large. To the extent that the brain drain contributes to the absence of people sufficiently skilled to adapt international technology to the domestic economy, it seems probable that it could reduce other beneficial international technological spillovers.

The literature on empirical spillovers refers only to technology spillovers generated by R&D expenditures. More generally, however, international knowledge transfers are generated by interaction among experts in a range of scientific and commercial fields. The transfer of knowledge at the leading edge of any specialized field often depends on a relative handful of individuals — this is certainly the case in Canadian universities, for example. It follows, then, that, where specialization is intense — as in the case of biotechnology, as we shall see later — the international transfer of knowledge can be severely hampered by the departure of a small number of brains. In fact, that the brain drain limits the rate at which international knowledge diffuses to Canada is probably one of the most compelling arguments that the phenomenon has a cost.

Brain Quality: The Superstar Model and Winner-Take-All Markets

If the brain drain debate is not about the relatively small aggregate *number* of brains leaving, perhaps it is about the *quality* of brains leaving. Most economic analysis works at a fairly aggregative level. Individuals are distinguished at best by general socio-economic characteristics such as age, education, occupation, and experience. Nevertheless, economists are well aware that a population of otherwise similar individuals contains vast differences in ability and effectiveness.

The fact that societies have relatively few highly talented individuals carries a number of implications for growth and resource allocation, as Baumol (1990) and Murphy, Shleifer, and Vishny (1991) emphasize. Landes (1969), for example, argues that England experienced the Industrial Revolution before other European countries because it was able to lever talent into entrepreneurship more effectively. In the context of the brain drain, therefore, if Canada is losing its talented people to the United States, this reduces the quality of the pool from which it draws its entrepreneurs, which, in turn reduces Canada's economic growth. Moreover, to the extent that talent is more highly rewarded in Canada for occupations that do not carry economic growth benefits, this also tends to reduce growth. Baumol (1990) suggests that, as an economy allocates its talent to rent seeking,[2] this has a directly negative impact on growth by pulling exceptional people out of occupations where their skills would produce economic growth, rather than merely increasing their private income.

Murphy, Shleifer, and Vishny (1991) attempt to get at this issue in a cross-country growth analysis by looking at the relative effects of the proportions of college students enrolled in engineering and law. They argue that, in most economies, a substantial part of legal activity is directed toward rent seeking or the administration of rent seeking. Looking at a sample of 55 countries with college enrollments exceeding 10,000, they find that the engineering share has a positive and significant effect on growth while the law share has a negative but also significant effect on growth. This confirms, at least indirectly, the existence of a tradeoff between the allocation of talent to productive versus unproductive activities. In Canada, as in most industrial countries, the highly talented participate in a broad range of activities. These arguments suggest that, to the extent Canada can shift the balance of the participation of the highly talented toward non-rent-seeking activities, such a move would have a positive effect on the country's economic growth.

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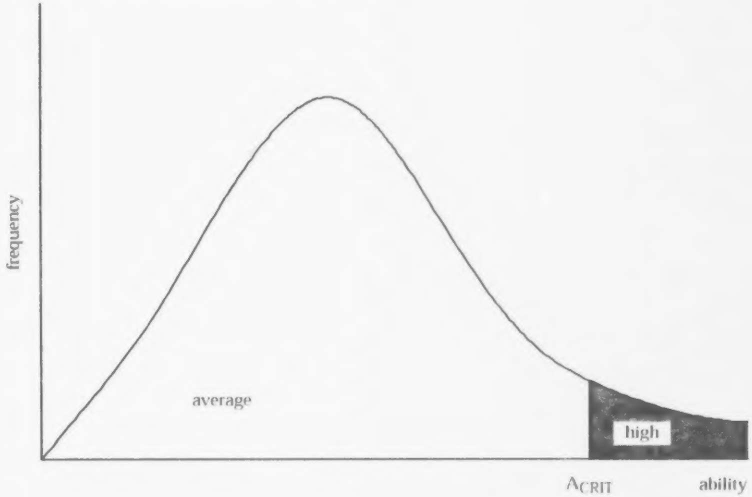
[2] Rent seeking is an economics term used to describe any activity by private individuals or firms by which they seek to obtain resources from government without necessarily providing any real service or economic output in return. Lobbying regulators for preferential treatment is a classic example of rent-seeking behaviour.

The contribution of exceptional individuals to the outcomes of their organizations is obvious in areas such as sports and executive management. Sherwin Rosen (1981) dubbed such individuals "superstars" and argued that they tend to occur in markets with "winner-take-all" characteristics. As Rosen (1981), Frank, and Cook (1995) and others argue, highly talented people tend to be attracted to such markets because of the high level of compensation. The overall structure of labour markets and policy interventions, however, affect how and where talent is allocated. Thus, the brain drain debate can be framed, in part, as the response of Canadian labour markets and policy to rewarding talent in a world in which the superstar phenomenon is increasingly important.

The general view of the brain drain is that those who are leaving are in the upper tail of the distribution along a quality spectrum. Economists know that proxies for ability, such as measured IQ and wages, more or less exhibit such distributions. If wages were strictly proportional to ability and if they also reflected productivity, the economic impact of the migration of a group from the upper tail of the quality spectrum (marked "high" in Figure 2) could be measured simply by lost wages. In Figure 1, this would approximate the reduction in GDP that corresponds to area *ABDC*. More important, however, is the effect of the departure of some of these individuals on the productivity of those remaining at all levels of ability. The standard competitive model of labour markets suggests that these effects are small if the number of individuals who are leaving is small.

The standard model might, however, be deficient in one important aspect. Those at the upper end of the quality spectrum fill key roles usually reserved for those of exceptional ability: managers,

Figure 2: ***Distribution of Ability***



team leaders, innovators, risk takers. This is the "Wayne Gretzky" model of the brain drain. One way to measure a hockey team's economic output is to look at its total gate, but this is a function of more than the sum of the abilities of the players on the team. In sports such as hockey, however, outcomes depend on having at least a few players of exceptional ability. The departure of a "star" lowers the team's visibility and performance so much that the loss in total economic output far exceeds the wage of the individual "star."

An important issue is how an economy allocates talent between markets where these "superstar" effects are important and where they are not. Frank and Cook (1995) argue that, in the United States, the increasing prevalence of winner-take-all markets is having a negative effect on the allocation of talent since too many highly talented people enter fields in which they can become "stars," rather than occupations that do not have such characteristics.

In general, the superstar effect is found in markets with three characteristics. First, the market must be large, since being a superstar in a large market (the United States) carries much bigger rewards than being one in a small market (Canada). Second, the market or activity must not be subject to strong internal forces of diminishing returns. If output is strictly proportional to time inputs, for example, there are natural limits to the superstar phenomenon. To the extent this is a limiting factor, highly talented people will be attracted to occupations where their impact is not limited by time inputs. It is commonly argued, for example, that entrepreneurship is an example of an occupation that overcomes this barrier — a talented manager can run a large firm just as well as a small firm. For this reason, entrepreneurs are among the most economically important kinds of superstars. Third, the market must have compensation contracts that allow the superstar to capture an attractive share of the rents generated by his or her talent. For example, entrepreneurship is less likely to attract superstars if the returns to innovation are not protected by intellectual property mechanisms such as patents. Moreover, individual output must be easy to observe and quantify in order to reward superstars appropriately.

The superstar issue is of relevance to Canada for two reasons. First, the large size of the US market and the increasing importance of winner-take-all aspect of segments of that market have made moving to the United States more attractive for highly talented people. Free trade should alleviate some of this problem by allowing entrepreneurs, for example, to participate in "superstar" contests from a Canadian base — it is just as easy to start a new high-technology firm in Kanata, Ontario, as in Boston. Nonetheless, the policy implication of the drain of the highly talented, rather than the merely averagely talented, southward is that Canada will have to find ways to retain its fair share of winner-take-all markets. The second reason the superstar issue is important to Canada is the potential consequences for growth of allocating talent to occupations that are primarily focused on rent seeking. To the extent Canada has a policy framework that rewards rent seeking, a larger fraction of the more talented people in the economy will be drawn to these activities, which, in turn, reduces economic output.

Costing the Migration of Potential Superstars

Many economic models have been developed to address the migration of "superstars," a number of them following a contribution by Nobel Laureate Robert Lucas (1978) on the formation of entrepreneurs. The basic idea is that the economy (or a sector) consists of a number of "teams" — firms, research labs, sports franchises — made up of groups of individuals with heterogeneous abilities drawn from a population with abilities as depicted in Figure 2. The key, however, is that each team must have leaders who make the important decisions regarding organization, incentives, innovations, and so forth.

Suppose the output of the team consists of team inputs, denoted $(A_1,.. A_n)$, and the ability of the team leader, T. One can then denote total output by a production function:

$$Y = F(T; A_1,\ldots, A_n).$$

For a given leader, output is an increasing function of the abilities of the remaining team members and subject to the usual laws of diminishing returns. Within this framework, one can make two simple assumptions. First, economic efficiency dictates that the best person should be the leader within the organization. That is, out of a group of n + 1 people, the person who is chosen as leader corresponds to finding

$$T = A_{max} = max_i\{A_1,\ldots, A_n\}.$$

Thus, the person with the highest ability level becomes the leader. The implication of this assumption is that, depending on how teams are formed and the compensation mechanisms for leaders, if competition rules at all, the more able will tend to be the leaders. In Figure 2, teams will consist of leaders drawn from the "high" group and other team members will come from the group of lower ability marked "average."

Second, on average, leaders of higher ability increase the team's total output. Thus, Y is an increasing function of T. More important, however, many forms of team production exhibit *increasing returns to ability*. This shows up most dramatically in cases where superstars emerge. These are individuals who may be just slightly more able than others in similar positions but whose margin of advantage results in large returns both personally and for the organization. Thus, in looking at two equal organizations but one has a team leader with ability T_1 and the other a team leader with lower ability T_2 , one can see increasing average returns to ability:

$$\frac{F(T_1)}{T_1} > \frac{F(T_2)}{T_2} .$$

For the brain drain debate, the implication of this type of framework with respect to the allocation of talent is significant if one presumes that migration outflows are heavily biased toward those of leadership ability. To keep matters simple, suppose there is a critical ability level, denoted in Figure 2 by A_{CRIT}, such that, initially, only those with a level of ability greater than this are suitable team leaders. The average team has a leader with ability level $A^* = E(A \mid A > A_{CRIT})$. Suppose the team experiences a brain drain that is replaced by someone of ability level just below A_{CRIT}. Given increasing returns to ability, the loss in economic output is equal to $F(A^*) - F(A_{CRIT})$. That is, the loss is equal to the difference between the total output of an existing team versus the total output of a team that is now just viable as a consequence of the lower quality pool of available team leaders. In many circumstances, this is a large number and one that vastly exceeds the average compensation of high-ability individuals. With increasing returns to ability, a brain drain of superstars from Canada to the United States would lead to a smaller pool of potential superstars in Canada, implying that team leaders in Canadian organizations would then be drawn from a pool with lower average than would be the case in the United States.

One argument against this view is that free trade and the increasing mobility of the highly talented should make Canadian locations as viable as US ones as a base from which to participate in winner-take-all contests involving the capture of the relevant North American market. Scientists, for example, should find it no more difficult to acquire an international reputation while based in a Canadian university than they would elsewhere. Nevertheless, individuals do move to the United States to pursue exceptional professional opportunities, perhaps due to other effects not captured in the Lucas model, such as the benefits of professional agglomeration in certain key US cities. Another possibility is that the relatively small size of the Canadian market imposes constraints on the highly talented that free trade cannot solve. For those services and manufacturing concerns where proximity to the customer is paramount, average compensation of superstars will be larger in the United States than in Canada, which inevitability will attract the highly talented to the larger economy. For scientists, a US location may offer closer proximity to and interaction with peers and, importantly, higher levels of research funding.

Measuring the Effect of Stars: The Case of Bioscientists

Most people recognize that "stars" are important and that their economic impact goes beyond their own compensation or the output of the immediate firms or activities in which they are involved. It is difficult to put numbers on this effect, however, because of the small numbers involved. Many sectors of the Canadian economy contain only a few firms of any significance and, although the loss of a single manager or scientist might be expected to have a very small effect, the economic impact could be extremely large.

Among the very few studies to examine the effect of critical individuals on the economy are several papers by Michael Darby and Lynne Zucker (and their co-authors) looking at the role of superstar scientists in the emergence of the biotechnology industry. These authors link the performance of individual firms with publications by their scientists in GenBank, the genetic sequence database maintained by the US National Institutes of Health. Darby and

Zucker find that, in the early days of the bio-technology industry, unintentional knowledge spillovers were relatively minimal and diffusion of knowledge among scientists was slow, but that that collaboration between a star scientist and scientists employed by a particular firm was a powerful predictor of the firm's success: "For an average firm, 5 articles coauthored by an academic star and the firm's scientists result in about 5 more products in development, 3.5 products on the market, and 860 more employees" (Zucker and Darby 1996, 12709). Darby, Zucker, and their co-authors also find that star scientists at US universities, though few in number — they identify just 207 publishing stars and 4,004 collaborators — virtually created the US biotechnology industry, particularly so-called new biotechnology enterprises (NBEs). Zucker, Darby, and Armstrong (2002, 139) summarize the findings as follows:

- Location of top, "star" scientists predicts location of firm entry into new technologies (both new and existing firms), shown for the United States and Japan in biotechnology (Zucker, Darby, and Brewer 1998; Darby and Zucker 2001) and replicated for the US semiconductor industry (Torero, Darby, and Zucker 2001).
- Ties that involve actual work at the science bench between star scientists (mostly academics) and firm scientists consistently have a significant positive effect on a wide range of firm performance measures in biotechnology (Zucker, Darby, and Armstrong 1998; Zucker and Darby 2001) and in semi conductors for number and quality of patents (Torero 1998). Ties to stars also shorten the time to IPO (forms are younger) and increase the amount of IPO proceeds (Darby, Welch, and Zucker 2001).
- As the quality of an academic star bio-scientist increases and his/her research becomes more relevant to commercialization, the probability increases that the scientist conducts joint research or moves to a firm. As expected scientific returns increase — measured by citations to other local star scientists working with firms — the probability that the next star will begin working with a firm also increases (Zucker, Darby, and Torero 2002).

One important finding from this research is the close relationship between the location of NBEs and that of star scientists. There is also strong evidence of synergy effects in that stars who are tied to NBEs publish more than scientists who are not. Darby and Zucker refer to these star scientists as "gold deposits" around which new firms are created or existing firms transformed.

The success of the United States in capturing the lion's share of the new biotechnology industry is striking, as Table 2 shows. Moreover, the drain of brains to the United States is a global phenomenon, as shown by the substantial rates of net out-migration from countries such as Canada, Switzerland, and the United Kingdom. For the brain drain debate, the relevance of this phenomenon is twofold. First, the migration of stars can have a disproportionate effect on economic growth. Second, in the case of biotechnology, it may well be the case that US "pull" factors are much stronger than any Canadian "push" factors. The lack of a viable Canadian alternative to the emerging US biotechnology industry has given the United States a clear lead and a strong incentive for Canadian stars to leave.

The Globalization of Labour Markets and Mobility

An alternative perspective to that of the brain drain, which depicts a one-way flow of talent from Canada to the United States, is what might be termed the "global mobility perspective." In some occupations, labour is already highly internationally mobile, which represents a shift from a time when labour was not mobile but limited migrations occurred subject to national controls. A number of factors might account for this shift in the permanent state of mobility, including developments in technology, greater freedom of movement under the North American Free Trade Agreement, and individuals' increasing preference for frequent job relocations. Clearly, however, costing changes in labour mobility policy regimes is quite different than evaluating a one-time migration. In this section, I

Table 2: ***Number, Commercial Involvement, and Migration Patterns of "Star" Bioscientists through 1990***

Region	**Stars**			**Movements**[c]				**In+Out**
	Total[a]	**Tied**[b]	**% Tied**	**Inward**	**Out**	**Net**	**Net/Tot**	**Total**
							(%)	(%)
APEC[d]								
United States	207	69	33.3	26	20	6	2.9	22.2
Japan	52	21	40.4	13	8	5	9.6	40.4
Australia	14	1	7.1	3	2	1	7.1	35.7
Canada	10	0	0.0	1	4	-3	-30.0	50.0
Total	283	91	32.2	43	34	9	3.2	27.2
APEC region	283	91	32.2	21	12	9	3.2	11.7
Europe								
Belgium	7	1	14.3	2	1	1	14.3	42.9
Denmark	3	0	0.0	0	0	0	0.0	0.0
Finland	4	0	0.0	2	0	2	50.0	50.0
France	25	0	0.0	3	2	1	4.0	20.0
Germany	24	0	0.0	7	5	2	8.3	50.0
Italy	1	0	0.0	0	0	0	0.0	0.0
Netherlands	5	1	20.0	2	2	0	0.0	80.0
Sweden	10	1	10.0	3	1	2	20.0	30.0
Switzerland	15	3	15.8	4	10	-6	-40.0	93.3
United Kingdom	31	3	9.7	4	14	-10	-32.3	58.1
Total	125	9	7.2	27	35	-8	-6.4	49.6
Europe region	125	9	7.2	12	20	-8	-6.4	25.6
Rest of world[e]	9	0	0.0	2	3	-1	-11.1	55.5
Total world	417	100	24.0	72	72	0	0.0	34.5

[a] Unique stars ever publishing in the country.

[b] Number of stars in the country who have ever published as or with an employee of a new biotechnology enterprise in the same country.

[c] Movement figures for region but excluding within region movements.

[d] APEC is the group of countries that are members of the Asia Pacific Economic Cooperation.

[e] Rest of world is Israel and the USSR.

Source: Zucker and Darby 1999.

look at the several aspects of the brain drain debate through the lens of changes in mobility.

Surprisingly, little analysis from this perspective has been undertaken in the North American context. In Europe, however, such a literature exists because of the importance of the role that policies to improve labour mobility have played in European economic integration. In particular, in a 2001 report, the Organisation for Economic Co-operation and Development (OECD) distinguishes between two possible outcomes of the mobility of the high skilled. First, there can be a "brain exchange" or "brain circulation" when increased mobility contributes to an increased two-way flow of knowledge, ideas, and technology. Second, there can be a brain drain, brain gain, and, in some cases, "brain waste," which occurs, for example, when, in moving, individuals take jobs that are beneath their skills, education, or experience.

For different occupational groups, the OECD recognizes a number of factors that explain their mobility:

- *Managers and executives* are typically sent abroad for just a year or two, often as a result of takeovers, mergers, and flows of foreign direct investment. This category represents a significant proportion of highly skilled migrants: in 1996, it accounted for 81 percent of 7,638 highly skilled migrants from the European Community to the United States.
- *Engineers and technicians* typically are attracted by economic opportunities in the host country. Foreign-born engineers account for a significant proportion — about 17 percent — of all engineers in the United States; the proportion is even higher for engineers with doctorates.
- *Academics and scientists* are encouraged to move by the importance of networking and face-to-face transfer of knowledge.
- *Entrepreneurs* are heavily influenced to move by the presence of economic opportunities, particularly in emerging technology sectors, by favourable policies on immigration and taxation in the host country, and by the availability of start-up capital.

- *Students* are attracted by a global job market, financial circumstances, and favourable immigration policies in the host country. Foreign students now constitute 3.8 percent of all university students, nearly double the proportion of the 1950s, and make an increasingly important contribution to the brain drain - more than 50 percent of European PhD students studying in the United States remain there after graduation. Foreign students also contribute directly to "brain circulation" by first taking a job abroad and then returning home bearing an important set of skills and contacts.

The Economic Consequences of Brain Mobility

Traditional supply-demand models are ill suited to providing a cost-benefit analysis of mobility. Rather, they predict the initial flows from a state in which labour is immobile to an alternative state in which real wages (inclusive of other nonpecuniary benefits) are equalized across locations. If only pecuniary benefits matter, then full labour mobility equalizes wages, net of moving costs. This leads to greater overall economic efficiency, although some regions may lose or gain depending on the pattern of relocation. Costing a shift from immobility to mobility, then, basically looks at the effect of opening up labour markets and equalizing factor returns. This type of evaluation, however, misses a number of important changes in the structure of labour markets that economic integration brings. In particular, "dynamic" factors figure significantly in changes in the labour mobility regime.

The mobility of the highly skilled affects long-term economic performance through at least two important channels. The first is the effect of mobility on returns to human capital and subsequent decisions about human capital acquisition. The second channel is the effect of mobility on increased specialization and international knowledge spillovers.

Human Capital Mobility Effects

The Lucas (1988) framework referred to above shows how differences in countries' education and other human capital acquisition policies with respect to immobile human capital can create differences in growth rates and income levels. In an important extension of the Lucas model to multiple countries with different initial levels of income, Razin and Yuen (1997a,b) show how the free movement of labour is essential if income levels are to converge. Their argument is that equalizing returns on human capital is the critical necessary condition for per capita income convergence to occur between countries, and free international movement of labour is the only policy regime that guarantees the equalization of returns on human capital across countries.

Of great interest is the finding of Razin and Yuen that free trade in goods plus free movement of capital is insufficient to insure income convergence in regions within a common market — that, in the absence of the free movement of labour, permanent income differences will persist among economies whose growth is driven by human capital. This finding provides a compelling intellectual case for policies that improve international labour market integration. In this section, I present a highly simplified version of the Lucas-Razin-Yuen framework to illustrate the intuition behind this fascinating result.

The Razin and Yuen (1997a,b) papers have two major implications for policies toward international labour mobility. First, assuming that physical capital is mobile across borders and there is free trade in goods, growth rates converge in the long run but income levels do not. Increased capital mobility does lead to a faster rate of convergence in rates of return and growth rates, but it is not sufficient to bring about income convergence. Given that countries start with different levels of human capital, there is no mechanism to equalize skill levels across countries; thus, wages and productivity do not equalize. This situation describes fairly well the situation of the past three decades, in which trade has been liberalized and capital movements have been relatively free.

Second, the movement of labour from a low-wage to a high-wage country — that is, from an economy poor in human capital to one rich in human capital — drives up wages in the human-capital-poor country, which leads to the critical supply-side response of increasing the rate of human capital accumulation in the poorer country. This process persists until wages and levels of human capital are equalized in the two countries, which eventually leads to a convergence of their income levels.

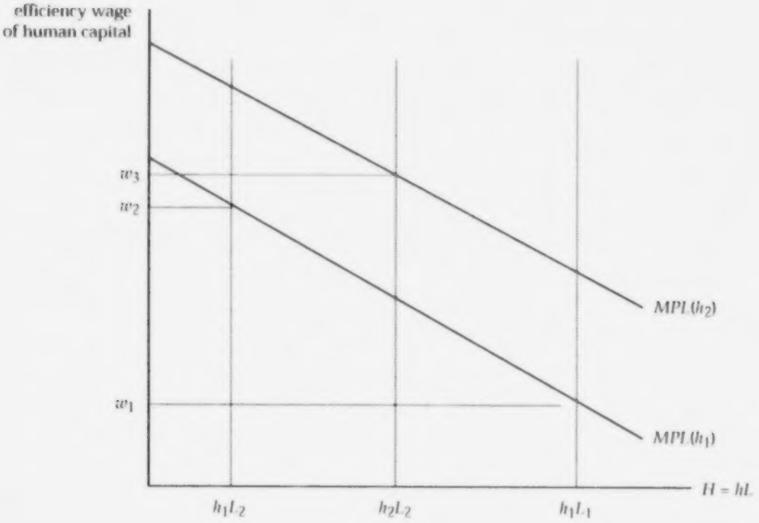
The following, which is a simplification [illegible]he Razin-Yuen model, attempts to motivate the basic results. Imagine an economy whose output can be described by a two-factor production function:

$$Y = A(h)F(K, H),$$

where H is the stock of human capital and K is the stock of physical capital (for the sake of simplicity, I ignore the role of K). The stock of human capital is measured by $H = hL$, where L is the number employed and h is the average human capital per worker. An increase in h increases the stock of human capital proportionately for a given number of workers and the efficiency of any given worker. H can also be referred to as the total supply of labour measured in labour efficiency units. Human capital also has a spillover effect on total factor productivity as displayed in the term $A(h)$.

Lucas notes that the average human capital level in an economy affects a number of avenues by which productivity improvements occur. Imagine an economy in which, initially, both h and L are fixed. In Figure 3, the demand curve for labour services, H, measured in efficiency units, is drawn as a function of the wage per efficiency unit. Let H_1 denote the initial supply of labour services given by h_1L_1. The effect of an out-migration of labour in this theory is similar to that already discussed: the number of people available for work drops to L_2, H drops to h_1L_2, and the wage per efficiency unit rises to w_2. This analysis, however, traces through a number of the longer-run consequences of this initial impact. Although one cannot determine the reasons for the decision to

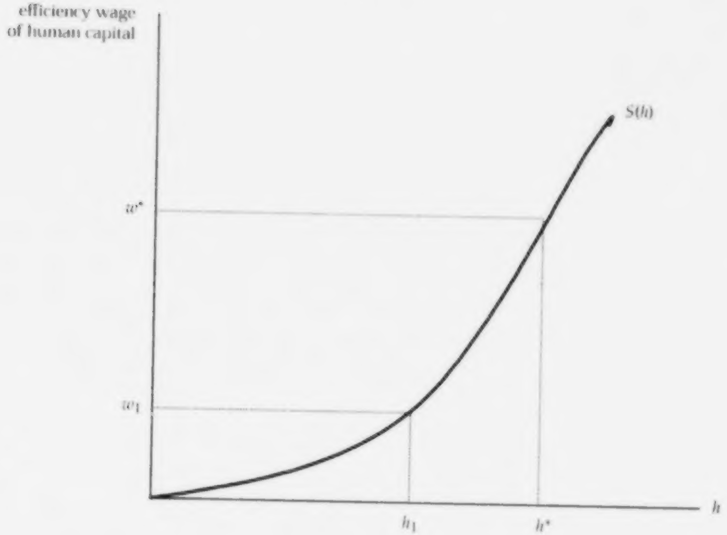
Figure 3: ***The Demand Curve for Labour***



move, presumably a worker with human capital level h_1 can earn more than w_1h_1.

The average level of human capital is presumed to adjust in the long run to the returns per unit h. These are proxied in this framework by the average efficiency wage, w, per unit h. In Figure 4, the supply curve for the average level of human capital shows that, as wages per unit h rise, the level of h that individuals acquire rises. The second-round effect of the initial brain drain, therefore, is that h rises to h_2 — that is, the average human capital per worker of those who remain rises. This has two important effects on economic growth. First, there is an impact on total factor productivity due to the increase in h. This is the Lucas human capital externality, and total factor productivity rises from $A(h_1)$ to $A(h_2)$. In Figure 3, this was depicted by an upward shift in the demand for labour curve from $MPH(h_1)$ to $MPH(h_2)$, since the marginal product of any quantity of labour is now higher than it was initially. The second effect is that the total supply of quality-adjusted labour services rises

Figure 4: ***The Supply of Human Capital***



from $H = h_1L_2$ to $H' = h_2L_2$. Depending on the relative strength of these two effects, the market-clearing wage of labour services can rise or fall. Under assumptions that are not too strong, one can expect that, at least initially, it will rise.

If one assumes the initial brain drain is exogenous, the dynamics of this process will continue, with rising average human capital level per worker, rising wages per efficiency unit of labour, and rising income per worker, until the process stabilizes such that the level of wages in the economy just sustains the investments in human capital that are being made. Imagine, however, that economic integration allows labour to move freely between countries. What impact would this have?

To keep matters simple, let us assume simply that one country is small relative to the other and that whatever migration occurs between the two does not affect the level of wages in the larger country. Let us suppose that the wage per efficiency unit of labour in the larger country is w^*, a wage substantially higher than the initial wage w_1 in the smaller, lower-income country. Suppose we also make the extreme assumption that, in the long run, migration will continue to occur as long as there is a difference in these wages between the two countries. This abstracts completely from any costs of migration — either pecuniary or nonpecuniary. If one were to ignore the supply-side responses discussed above, the only avenue for adjustment would be an exodus of people until there was sufficient labour scarcity that efficiency wages were equalized. This process would not equalize incomes because, without a change in the average level of human capital, h, productivity could not be equalized. If one assumes, however, that the microeconomics that drive decisions to invest in human capital are the same in both countries, such that the supply curve, $S(h)$, in Figure 4 is the same in both countries, equalization of efficiency wages would give rise to equalization of the average level of human capital in both economies at level h^*. This, in turn, would imply a convergence of total factor productivity levels in both economies — the $A(h)$ term — and thus ultimately income per capita. The dynamics of this process with respect to the size of the labour force are indeterminate without additional assumptions.

Two sets of dynamics are at work here. First, migration dynamics dictate the rate and speed at which individuals move from the low-wage to the high-wage country. Second, productivity and education dynamics increase returns to human capital, which, in turn, increase individuals' average level of investment in human capital. In this simple framework, the latter set of dynamics is driven solely by the wages in the country of residency. Several papers suggest, however, that this model understates the effect of international mobility on the supply of human capital. For example, Stark, Helmenstein, and Prskawetz (1998) develop models in which the emergence of an option to move increases everyone's investment in average human capital, even if they do not exercise the option. Thus, a credible and permanent change in the mobility policy regime might increase the elasticity of the response of h to the difference between w and w^*.

The relevance of this framework to Canada is considerable. High returns in the United States to specific types of skills contributed initially to the observed brain drain, as this theory would predict. The longer-run consequences, however, should be a bidding up of wages for skilled labour in Canada and additional increases in the average level of human capital in the labour force — and thus higher levels of productivity in this country. Indeed, some of these effects are now becoming evident — in certain professions, wages are starting to rise dramatically. Yet, if labour was fully mobile across the border and technology in the production of human capital was similar in the two countries, both their productivity and rates of return to human capital acquisition ultimately would be equal, which, in turn, would lead to income convergence.

One can, however, make two criticisms of this framework as it relates to Canada. First, levels of human capital in Canada are broadly perceived to be high. Certainly, there is evidence that Canada has been catching up with the United States, which explains in part why the increase in the education premium has been lower in Canada than south of the border. Nevertheless, as indicated in a 1998 OECD study, by a number of measures Canada's performance in the creation of human capital lags that of the United States. Second, reality falls short of the type of free labour mobility that the model assumes. A substantial part of the brain drain has been in particular areas, such as the information technology sector, where large labour shortages emerged in the United States during the 1990s. A more appropriate interpretation of the theory, therefore, is as it pertains to specific occupations and occupation-specific human capital. It is possible that the presumed supply response might also be occupation specific. The narrower the occupation, the less likely it is that the response would be a general increase in the productivity of all types of labour. In this instance, the supply-side offsets to the initial brain drain would be weaker than the aggregate model suggests.

Global Mobility and Knowledge Flows

Some segments of the labour market are both globalized — in the sense that the industry of employment is knowledge based and global in scope — and have a high degree of international mobility. These include not only high-technology industries, but also management of multinational enterprises as well as scientific and technical professions. Movements of persons from one country to another can be regarded not so much as the international transfer of human capital as the manifestation of the increased mobility of the knowledge embodied in these individuals, who have become global knowledge workers — knowledge workers facilitate knowledge transfers. The reason people, rather than, say, a simple computer and web link, are important is that much useful knowledge is noncodified and tacit. Recent work on the knowledge economy has drawn increased attention to the importance of tacit knowledge and the mechanisms by which it is created and distributed — see Harris (2001) for a review and discussion. As such knowledge becomes more important, person-to-person communication and interaction also become relatively more important for the diffusion of knowledge. The globalization and tacit knowledge perspective thus calls for a different approach to evaluating the welfare consequences of particular migrations, as well as the policy regime that governs labour mobility as a whole.

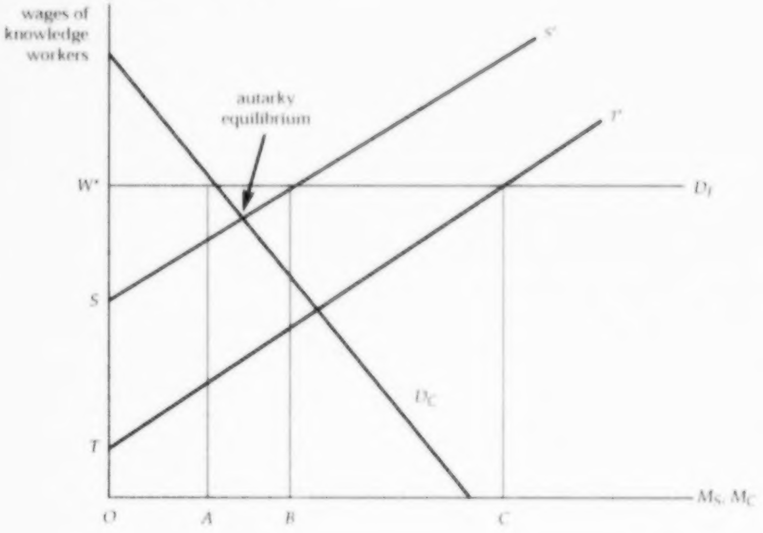
One way to approach this problem is to view the labour market as being divided between those jobs that are part of the global knowledge economy and those that are not. Obviously, however, such a classification is somewhat artificial, as some jobs could as easily be classified as both national and global in scope. The usefulness of this framework hinges on a twofold classification. First, one must determine whether knowledge spillovers across relevant organizations are largely national or global in scope. Second, movement between jobs within the global knowledge sector, even if it involves changes in location, is subject to much less friction than movement from the nonglobal sector to the global sector. The working assumption here is that most people would classify themselves in the former group — that is, they would not routinely view their alternative opportunities to their current job as being outside the national or even local labour market. Truly globally mobile workers, however, are much more likely to accept a job — be it in London, Hong Kong, or Toronto — based on characteristics other than its location. The emergence of global knowledge workers became noticeable in the 1990s, driven by technology, the increased globalization of corporations, and a long economic expansion. For Canada, the emergence of this market occurred in parallel with renewed concerns about the brain drain to the United States. As a result, it is easy to misinterpret the likely ultimate causes and consequences of the observed migration of highly skilled Canadians, and thus to suggest a policy response that might be inappropriate. Accordingly, in this section, I lay out a simple model of segmented labour markets — one national, the other characterized by global mobility — and illustrate some of these issues.

A Model of National versus Global Knowledge Workers

Let us start with the assumption that an individual's decision to become a global knowledge worker involves both considerable cost to the individual and foregone alternatives in the local economy. Let us also assume that there is, at a point in time, a supply curve for such highly skilled individuals and that they are citizens of Canada, which is a small, open, national economy.

In Figure 5, the supply curve is increasing in the wage depicted as *SS'*. The elasticity of this supply reflects in part the propensity of individuals to shift from a locally based labour market to a global one. We take the geographic distribution of demand for these types of workers as given — that is, jobs are available for them in places such as Toronto, Montreal, New York, San Francisco, and a number of other locations at home and abroad. To simplify, however, let us distinguish between just two locations, Canada and the United States. The presumption is that the US demand for these workers is so large relative to the Canadian supply that the demand for work-

Figure 5: *The International Mobility of Global Knowledge Workers*



ers originating in Canada is perfectly elastic at wage W^*. This is the horizontal line D_F in Figure 5. Demand in Canada for these workers is downward sloping, denoted by D_C. Given the complete mobility of these workers, wages are the same for jobs available to them in both countries — although, in practice, wages would have to be appropriately adjusted for differences in the cost of living, nonwage perquisites, and so on. Given the initial supply curve of Canadian-based globally mobile workers, those in the range *OA* find employment in Canada and the rest, in the range *AB*, are employed abroad.

Now, suppose a sudden reduction in the cost of becoming globally mobile — for example, lower airfares, better communication systems, and a general willingness to seek employment opportunities offshore — results in a shift in the supply curve from *SS'* to *TT'*. The source of these shifts can be referred to as mobility biased supply shifts. With unchanged demand, the number of those who end up working abroad rises from *AB* to *AC*. Given the high skill levels of these individuals, this could be identified as a brain drain. An alternative driver would be an increase in economic opportunities abroad, as reflected in an increase in wage W^*. Given both unchanged home demand and wage W^*, this would increase the number of mobile workers employed abroad and decrease the global work-force employed at home, albeit at higher wages.

The analysis thus far ignores an important aspect of global mobility — the nature of the knowledge spillovers among individuals in the global pool and the effect this has on the productivity of factors of production that are not globally mobile. The point of view taken here is that knowledge spillovers in these types of jobs are not geographically limited, but they are, however, limited to the people who regularly interact in these types of global networks. To illustrate, assume, for example, that Canadian output Y_C is produced with a production function

$$Y_C = \Gamma\ (M_S, M^*)\ F\ (N, M_C).$$

The two factor inputs are immobile Canadian workers, N, and global knowledge workers employed in Canada, M_C. The total number of knowledge workers supplied from Canada is denoted by M_S. Output depends on knowledge spillovers proxied here by the total factor productivity term, Γ, and the private production function, F.[3] Total factor productivity, however, is a function of the amount of global knowledge generated by the total global knowledge work force, M_S plus M^* — that is, globally mobile workers from both Canada and the United States.[4] Canadian-based knowledge workers serve two distinct functions in this framework. First, as captured within F, they facilitate privately appropriable technological diffusion valuable to an individual firm. Second, they

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3 The Canadian demand curve for knowledge workers would be given by the private marginal product of these workers, equal in this model to ΓF_M.

4 To keep the analysis simple, I ignore global knowledge workers from other countries. This is obviously unrealistic, however, and would need to be amended in any application of the model.

facilitate external nonappropriable knowledge transfers by interacting with other global knowledge workers, as captured in the total factor productivity term. The important distinction here is that productivity depends on the total stock of global knowledge workers, not just on those employed in Canada. For example, a brain drain caused by either a shift in the supply curve of mobile workers or an increase in external demand corresponds to an increase in M_S but not M_C. This increase in the stock of knowledge workers leads to increased productivity at home and, thus, higher wages for all. A particularly favourable view of this process is the brain-circulation hypothesis, according to which all workers in the global knowledge pool cycle in and out of the global knowledge pool, in each case carrying the knowledge they acquired back to the home economy.[5]

The New Economy, the Brain Drain, and Productivity Gaps

The model we have just examined can be used to provide a perspective on the relationship between the "new economy" boom in the United States, the widening Canada-US productivity gap, and the brain drain of the late 1990s.

The new economy boom — generally attributed to the ICT revolution and a US-based bull market in equities — created an increased demand in the United States for global knowledge workers, depicted in Figure 6 as the increase from W^* to W^{**}. For Canadian-based knowledge workers, this increased US demand has a number of effects in our model. First, the number of Canadian-employed knowledge workers falls from *OB* to *OA*, while the total supply of Canadian knowledge workers increases from *OC* to *OD*. This, in turn, can be measured as an increase in the brain drain, as the increase in the number going abroad is equal to *AB* plus *CD*. The

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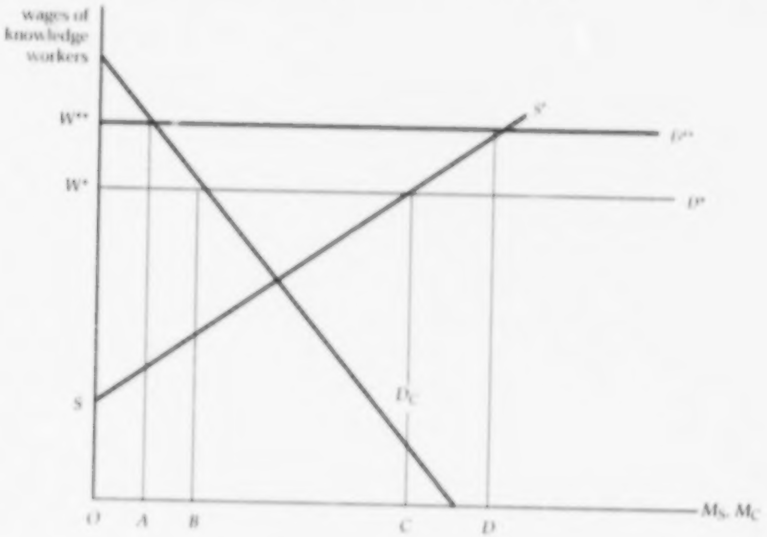
[5] The brain-circulation hypothesis appears to have been first advanced by Johnson and Regets (1998) in a study of the return migration of students studying science and engineering in the United States.

Figure 6: ***The U.S. New Economy and Productivity Gap***



impact on productivity depends on two distinct effects: the knowledge spillover effect and the internal productivity effect, which reflect the increased scarcity of Canadian-based knowledge workers. The decrease in M_C tends to lower the average labour productivity of the bulk of the labour force as measured by output per worker, Y_C/N. At the same time, however, total factor productivity tends to rise with the increased spillovers as M_S increases together with the implied shift of external knowledge, given the US new economy boom. As this model is static, it does not adequately capture the timing of these effects. Most likely, the spillover effect occurs with longer lags than the internal productivity effect — indeed, the widening productivity gap between Canada and the United States in the late 1990s reflects, to some degree, this difference in timing. The ICT revolution in the United States led to a brain drain that reduced the scale of the Canadian-specific ICT productivity boom; at the same time, it set the base for subsequent larger external knowledge flows back to Canada as the number of Canadian knowledge workers increased. This story is broadly consistent with what we know about the source of the Canada-US productivity gap as summarized, for example, by Bernstein, Harris, and Sharpe (2002). Of particular interest are the results of Bernstein and Mamuneas (2000), who find evidence of a slowdown in the rate of Canada-US spillovers in the late 1990s as one reason the gap opened up during this period.

Policy Implications

The assumption that global knowledge spillovers work in the way I have described in the foregoing model is extreme, but it captures the basic idea. Increased global mobility can be viewed as a valuable attribute of the national labour force. Once individuals enter global markets, they participate in networks through which knowledge is shared and transferred. These benefits accrue globally, but the benefits also fall to the domestic national economy — indeed, the benefits to the national economy may even be greater as a result of the external employment of knowledge workers if they serve as preferential conduits for the reverse flow of knowledge. For relatively small economies such as Canada's, this can be quite important, since most ideas are developed abroad and expatriates may provide better access to those ideas and faster technology transfer than would otherwise be the case.

From a policy perspective, therefore, the larger issues are the extent and pace of global knowledge spillovers. But, for an economy highly dependent on global knowledge, a pool of nationals who participate in the global knowledge industries, whether located at home or abroad, is a valuable resource. Recent evidence suggests the magnitude of these spillovers is quite substantial, although most of this work relies on data using R&D stocks, rather than knowledge workers — for a recent survey, see Keller (2001a,b). The general conclusion of this literature is that, for small industrial countries, international stocks of knowledge, as proxied by foreign and global R&D stocks, are much more important than domestic stocks in explaining productivity growth, and that, on balance, these effects appear to be very important. Thus, Canada's participation in global knowledge industries likely is of growing importance in sustaining a high rate of growth of productivity growth and living standards.

Governments often devise policies that seek to retain the highly skilled at home. Is there any justification for such policies within the global knowledge framework? If the knowledge transfer effect were entirely external, then the location of highly skilled workers would be largely irrelevant. One can argue, however, that having the domestic capacity to receive and implement global knowledge transfers is also important and, therefore, to the extent that such transfers are not captured in market transactions, subsidies might be appropriate.

As in the case of all market-failure arguments, one must be careful that the cure is not worse than the disease. In the extreme, one might argue, for example, that a country should retain all of its knowledge workers at home, but then firms would not locate in that country if they were unable to move their knowledge workers when became effective to do so in serving the larger market. In other fields subject to intense specialization, a period of interaction or study abroad may be a necessary condition for the tacit knowledge transfer to occur.

Generally, therefore, the message that one wants to take from this perspective is that what is of value is mobility *per se*. Over a lifetime, a Canadian knowledge worker may spend a number of periods working in the United States or elsewhere abroad while largely being domiciled in Canada. This is good for the worker and it is good for Canada. In the long run, Canada's best option is to implement policies that encourage global knowledge industries to locate here.

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Competition for Foreign Talent and International Labour Mobility

Nicolas Schmitt
and
Antoine Soubeyran

In this essay, we investigate the brain gain phenomenon within a simple two-country model and its links with other forms of international labour mobility as well as with the entry and exit process of firms. Specifically, we analyze how foreign workers and entrepreneurs allocate themselves between two countries both when domestic talents cannot move freely to the other country and when they can do so. We also investigate how this allocation of foreign talent affects each country's market wage as well as the number and the size distribution of firms.

The essay is motivated by two considerations. First, the growth of knowledge-based industries is very much driven by the ability of talented individuals, whether domestic or foreign, to create new firms. The emergence and the growth of the biotechnology industry

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The initial research for this paper was undertaken when Nicolas Schmitt was visiting the Université de la Mediterranée and Groupement de Recherche en Économie Quantitative d'Aix-Marseille (GREQAM) in fall 2000. He thanks both institutions for their hospitality; he would also like to acknowledge financial support from the Donner Canadian Foundation.

in the United States is a fascinating case underlying the critical importance of talented scientists to develop ideas and processes that they then exploit by creating firms (see Zucker, Darby, and Brewer 1998). To capture this idea, we specify a model where talented individuals have a choice between being entrepreneurs or workers. This naturally attenuates the wage effect that exists when individuals' activities are completely specialized, but it also has the advantage of introducing a simple process of entry and exit of domestic firms in response to a brain gain. To capture the idea that these talented individuals are stars, the model exhibits increasing returns to an entrepreneur's ability. Hence, firms with more talented entrepreneurs are larger and earn a higher profit. A brain gain thus has important efficiency gains.

The second motivation is that a country like Canada, although it does attract talented foreigners, may not attract the best of them, who prefer to go to the United States; at the same time, it may also lose some of its best domestic talents to the United States. A two-country model allows us to identify some of the causes of these phenomena; it also allows us to look at the effect of introducing international labour mobility between Canada and the United States on the allocation of talents coming from outside North America. This is an important theme in the European Union, where there is already free mobility of workers, and in North America, where new initiatives aiming at improving labour mobility between Canada and the United States cannot be excluded (see Harris and Schmitt 2004).

We show, first, that the allocation between Canada and the United States of talents coming from outside North America depends strongly on their relative migration costs, on their relative states of technology, and on variables determining country size and group sizes within each country. In particular, a country that imposes a high cost on those who would migrate to it can attract foreign talents only if it has some compensating advantages, such as better technology. In this case, the foreign talents that are attracted are only the best ones, while the others migrate to the country with the lower cost of migration. We then show several effects of this inflow of foreign talents: it increases the equilibrium wage in each country and it induces the exit of some domestic firms as well as the entry of new ones whose entrepreneurs come from abroad.

Allowing domestic workers to move freely from one country to the other has very different implications, depending on the pattern of worker mobility. Naturally, labour migration lowers the cost of labour in the country of immigration relative to the country to which it emigrates. Moreover, when foreign talents are entrepreneurs, they tend to migrate in greater numbers to the country where workers also migrate. International labour mobility, therefore, boosts firm creation in the country of immigration and induces the exit of firms in the country of emigration. Which is the country of immigration turns out to depend essentially on the two countries' relative states of technology. If their technology is similar, the country of immigration tends to receive the lesser-talented foreign individuals; if their technology is significantly different, the country of immigration tends to receive the best foreign talents.

This result is interesting because it shows that, in the first case, international labour mobility is a re-equilibrating force as far as both the allocation of foreign talents and firm creation are concerned. An example of this phenomenon might be the Canadian-US case, where Canada receives individuals from outside North America who are less talented than those going to the United States. It suggests that allowing workers to move freely between the two countries would help Canada by boosting firm creation by both domestic and foreign entrepreneurs. In the second case, however, international labour mobility further tilts the allocation of foreign talents in favour of the country already receiving the best individuals. An example of this case would be international worker mobility between a developed and an underdeveloped country, where the allocation of talents and firm creation would favour the developed country.

When local entrepreneurs, but not workers, are able to move freely between two countries, they have incentives similar to those of the foreign talents: they want to be wherever their earnings are higher. This usually means that, if they move, they go where the best foreign talents also want to go. This implies that a country quite naturally might lose its best talents, and thus its most productive firms, while not getting the best available talents from outside North America. Still, more foreign talents are being attracted to replace the departing local entrepreneurs and these firms may be more productive than the exiting ones.

Although this essay is essentially devoted to the effect of the arrival of talented individuals (a brain gain), the other side of the coin for the country from which those individuals depart is, of course, a brain drain. Moreover, the loss of skilled labour may also mean the loss of both human capital and returns to investment inherent in the public subsidization of education. We do not, however, look at the link between a brain drain and human capital formation.[1] Instead, we restrict ourselves to a one-sector model in order to investigate how foreign talents allocate themselves between two countries and how this allocation affects the entry and exit process of firms in the two countries in the presence or absence of international labour mobility.

The essay is organized as follows. In the next section, we analyze how foreign talents choose the country to which they will migrate and the effects of this brain gain on the immigrant country. In the following two sections, we contrast the brain gain in Canada and in the United States when international labour mobility (whether by workers or by local entrepreneurs) between these two countries is allowed and when it is not. In the final section, we discuss a few policy implications of our analysis. The main part of the essay is followed by an appendix in which we lay out the basic structure of our two-country model and the general equilibrium implications that are derived from it.

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[1] This link is examined in, for example, Bhagwati and Hamada (1974, 1982); Markusen (1988); and Djajic (1989). Here, we deal more with the consequence of the mobility of skilled labour for the creation of new firms and thus for the size of knowledge-based industries. As such, this essay is more closely associated with Rauch (1991). We use the same underlying model of agent's choice of activity as he does. However, he introduces this choice of activity into a two-by-two Heckscher-Ohlin-Samuelson trade model in order to investigate the links between patterns of trade and patterns of migration.

The Economy and Brain Gain

To understand how talents coming from outside North America can influence the Canadian economy, it is important to understand first how this economy functions without them.[2]

We consider that, in a country like Canada or the United States, individuals who participate in the labour force are differentiated by talent and that they choose to be either workers or entrepreneurs. Talent is more useful for entrepreneurs than for workers — in other words, workers with different talents may have the same productivity, but entrepreneurs with different talents do not have the same impact on the firms they are leading. An entrepreneur with more talent organizes his or her firm better or takes better advantage of the existing technology, which makes the firm more successful in the market than a firm run by a less-talented entrepreneur. Since entrepreneurs earn their firms' profits, more-talented individuals tend to be entrepreneurs and earn higher profits while less-talented individuals tend to be workers and earn the market wage. Of course, entrepreneurs — and thus firms — need workers, and their wages are determined by the demand for labour (which depends on the number of firms) and by the supply of labour (which depends on how many individuals choose to be workers). Since each group needs the other, there are always workers and entrepreneurs in the two countries.

To find out who is doing what in each country, one can consider individuals who are indifferent between the two activities. In this framework, individuals with talent levels below those who are indifferent are workers and those with talent levels above this threshold are entrepreneurs. This approach has several advantages. First, the number of firms in each country is determined by market conditions. Second, firms are differentiated by size and profitability: firms headed by more-talented entrepreneurs tend to be bigger and more profitable than firms headed by less-talented entrepreneurs.

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[2] See the appendix for more details.

Why is this framework useful to investigate the effects of brain gain on Canada or the United States? Below, we assume that the skilled individuals coming from outside North America are sufficiently talented to be entrepreneurs themselves.[3] Hence, when these foreign talents migrate as entrepreneurs, the demand for labour increases in both countries, which, in turn, causes the market wage to increase. The higher wage then causes some existing firms to exit because more domestic individuals want to become workers. In other words, new firms enter (because of the migrant-entrepreneurs) and other (domestic) firms exit. When the migrant-entrepreneurs are more talented than local entrepreneurs, the net effect must be a net decrease in the number of firms in each country since the new firms are more efficient than the exiting ones. Hence the inflow of foreign talents has considerable efficiency gains because it contributes to change in the structure of industries.

We now ask how this pool of talented individuals coming from outside North America allocates itself between Canada and the United States. We continue to assume that these foreign talents become entrepreneurs whether they migrate to Canada or to the United States and that they are differentiated by talent. For the time being, suppose also that this migration of talents is the only possible international migration — that is, there is no movement of entrepreneurs or workers between Canada and the United States (we relax this assumption in the next section). Finally, assume that these foreign talents contemplate earnings in their new country sufficient to cover the costs of migrating — such as the resources incurred to migrate, different tax treatment in the two countries, differences in culture or language, and differences in countries' efforts at integrating new migrants.

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[3] This assumption is not as unrealistic as it may first appear. Countries like Canada and the United States already attract a large share of the best talents that wish to move from the rest of the world. The fact that such talents become entrepreneurs "immediately" after migrating comes only from the use of a purely static approach.

Like local entrepreneurs, foreign talents take prices, technology, and wages as given. A foreign individual naturally chooses to migrate to the country where profits are higher. We make the important assumption throughout this essay that the fixed cost of migrating to the United States is higher than that to Canada.[4] One implication of this assumption is that the best among the foreign pool of individuals will migrate to the United States while the others migrate to Canada. It is not difficult to see why. If the cost of migrating to one country is higher than the cost of migrating to another but in all other aspects the two countries are identical, then all foreign migrants will choose to go to the lower-cost country. Hence, to attract a foreign entrepreneur, the country with the higher entry cost must have some advantage, such as better technology or lower workers' wages.[5] But if it is the case that the United States must have a technological or labour-cost advantage to attract migrants from outside North America, a foreign entrepreneur will necessarily earn a higher profit (gross of the cost of migrating) in the United States than in Canada. Since, in addition, profits increase with levels of talent, more-talented individuals will want to migrate to the United States even if the cost of doing so is higher, while less-talented individuals will prefer the cheaper country in terms of migration costs — that is, Canada. The general effects of this inflow of migrant-entrepreneurs are the same as those described above, but, everything else being equal, they are stronger at the margin in the United States than in Canada because of the differences among foreign talents.

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[4] In fact, we have no hard evidence that the cost of migrating to the United States is higher than it is to Canada. However, the cost of migrating may best be associated with the cost of integrating into a new country. If this cost is inversely proportional to the share of individuals born abroad in the total population of that country, then our assumption is consistent with the Canadian-US case.

[5] Here, too, the implication about technology is reasonable insofar as the United States is the world leader.

Internationally Mobile Workers

In the previous section, we assumed that the foreign pool of entrepreneurs is the only source of internationally mobile labour. We now assume that local workers are also free to move between Canada and the United States but that local entrepreneurs are not.

Leaving aside migration costs, since complete mobility of labour leads to an equalization of wages in the two countries, the flow of workers is then determined by relative shortages and surpluses of workers in the two countries. In which direction will workers migrate? What is the effect of the free movement of workers between Canada and the United States on the allocation of entrepreneurs coming from outside North America? Result 1 answers these two questions when the state of technology is not significantly higher in the United States than in Canada; Result 2 does likewise when this difference is significant.

Result 1: When the state of technology is similar in the two countries, internationally mobile workers will tend to move from the United States to Canada. As a result, more entrepreneurs migrate to Canada from outside North America as compared to the case without worker mobility between Canada and the United States.

The reason for this result is as follows. If the state of technology is not significantly superior in the United States, then the higher cost of migrating to that country which talents from the rest of the world face must be compensated by some other advantage in order to attract them. In the US case, tha: advantage is a technological one or a lower market wage that these entrepreneurs must pay the workers they employ. But if that is the case, allowing workers to migrate between Canada and the United States must lead workers to move from the United States to Canada, not the other way around. The effect of workers' moving from the United States to Canada is to increase wages in the former (ignoring the size effect) and decrease them in the latter. Since wages are then lower in Canada when workers are internationally mobile than when they are not, those lower labour costs attract foreign entrepreneurs to Canada, who then create jobs that attract more US workers. In this case, introducing the free movement of workers acts to re-equilibrate the distribution between the two countries of talents coming from the rest of the world. Indeed, another implication is that the average quality of foreign talents going to each country is higher with international labour mobility than without it, since the additional talents going to Canada are at the lower end of the range of talents that would otherwise migrate to the United States if labour were not internationally mobile.

Suppose now that the state of technology in the United States is substantially higher than in Canada. What is the effect on internationally mobile workers?

Result 2: When the state of technology is sufficiently superior in the United States so as to induce workers to migrate there from Canada, international worker mobility increases the share of foreign talents migrating to the United States compared to the equilibrium without international worker mobility.

The reason for this result is as follows. If technology is significantly better in the United States and workers are not internationally mobile, wages are higher in the United States than in Canada. If workers are allowed to move freely, however, they are drawn to the United States by the higher wages prevailing there. Mobility then decreases wages in the United States and increases them in Canada until they are equalized. The decrease in wages in the United States then attracts more foreign talented entrepreneurs to that country than would be the case without the free movement of labour. In this case, international labour mobility clearly favours the United States, where the best foreign talents already enjoy better technology.

These results have important implications for Canada. Insofar as it enjoyed the advantage of lower costs of migration than the United States, Canada would benefit from an internationally mobile labour force, on the reasonable assumption that technology in the two countries is not fundamentally different. Indeed, free worker mobility would attract to Canada not only US workers but additional foreign talents as well. This, in turn, would boost the creation of new firms in Canada by both foreign and domestic entrepreneurs. If the state of technology were significantly different in the two countries, however, the situation would be more like what one sees with developed versus developing countries. The free movement of labour not only attracts workers from developing to developed countries but also induces more-talented individuals from developing countries to take advantage of the significantly better technology in developed countries.

Internationally Mobile Entrepreneurs

The last case we investigate is where local entrepreneurs are internationally mobile but workers are not. This case is particularly relevant for Canada, since the North American Free Trade Agreement already permits some skilled individuals, including entrepreneurs, to move freely between Canada and the United States, but not unskilled workers.

We begin by assuming that domestic entrepreneurs face a migration cost that is equal to or lower than that faced by those coming from outside North America. A domestic entrepreneur then migrates only if earnings, net of the cost of migration, are higher in the new country (say, the United States) than they are at home (say, Canada). In this example, if domestic entrepreneurs are internationally mobile, the demand for labour rises in the United States and falls in Canada, which increases the equilibrium wage in the former and lowers it in the latter (recall that workers do not move between the two countries). This has the following result.

Result 3: If some local entrepreneurs move between the two countries, they necessarily migrate to the United States, as do the best talents from outside North America.

This result can be explained in the following way. When some local entrepreneurs move from one country to the other, there is never a simultaneous move by local entrepreneurs in the other direction since, given the cost of migrating, a firm's profit is higher in one country than in the other. In our earlier example, we saw how the best foreign talents earn more in the United States than in Canada; the same is true for local entrepreneurs when their cost of migrating is equal to or lower than that faced by foreign talents. Thus, given our assumptions, when local entrepreneurs want to move, they do so from Canada to the United States. Of course, the cost of migrating to the United States does not need to be equal for both Canadian entrepreneurs and foreign talents. In particular, if the cost is lower for Canadian entrepreneurs, then both the best Canadian entrepreneurs and the best foreign talents move to the United States.

Interestingly, this does not mean that Canada necessarily loses from the international mobility of local entrepreneurs. Indeed, in this scenario, more foreign talents from the rest of the world migrate to Canada than would be the case if local entrepreneurs were not internationally mobile. Given our assumptions, this substitution of local entrepreneurs by foreign ones increases the average talent of entrepreneurs in Canada and thus the average size of Canadian firms. Still, it is also true that, of the two countries, only Canada loses local entrepreneurs and also does not get the more able foreign talents. Hence, if anything, the free movement of workers has a greater positive effect on firm creation in Canada than does the free movement of entrepreneurs.

Conclusion

This essay makes two general points about the international mobility of brains. First, a brain gain has general equilibrium effects, not only on wages, but also on the individual agent's choice of activity. This has important implications for the exit and the entry of firms and, thus, for the number and size distribution of firms. Second, a brain gain cannot be looked at in isolation from other types of international factor mobility. Here, we have concentrated our analysis on two separate types of labour mobility to investigate the international allocation of foreign talents: the international mobility of workers and that of local entrepreneurs.

Our analysis reveals a number of interesting results. First, the mobility of individuals between two countries like Canada and the United States has nontrivial implications for the allocation of talents coming from outside North America that differ depending on whether the mobility involves workers or local entrepreneurs. Indeed, in the absence of international labour mobility between two particular countries, the best talents coming from elsewhere migrate to the country with the higher entry costs provided it also has the lower wages in terms of efficiency units. The share of the foreign pool that country can attract then depends on both the state of its technology and its labour costs relative to the other country.

Allowing labour to move freely between two countries may either improve or deteriorate the share of the foreign pool of talents each country would obtain in the absence of such labour mobility. In the case of Canada and the United States, however, free worker mobility between the two countries would increase Canada's share of foreign entrepreneurs and thereby boost firm creation in this country. It is the case at least if one accepts the fact that the cost of migrating from outside North America to the United States is higher than it is to Canada and that technology is similar in the two countries.

If local entrepreneurs, rather than workers, are allowed to move freely, the effects are somewhat different since entrepreneurs respond to profits, not wages. Local entrepreneurs who migrate always do so to the same country that attracts the best foreign talents. Hence, if local entrepreneurs move at all, the best Canadian ones migrate to the United States. This is not surprising, since the United States has lower wages and/or better technology, so that firms earn higher profits there. At the same time, however, the outflow of Canadian entrepreneurs is offset in part by the ability to attract a greater share of foreign talents.

The analysis suggests two types of public policies that can be used to attract foreign talents. The first type relates to the cost of migrating — examples of such policies are the temporary tax exemption recently adopted by Quebec or those aimed at facilitating the integration of immigrants. It is not that this parameter is more important than others but simply that any policy affecting the cost of migration is necessarily more direct and thus more efficient than acting on the state of technology or on the supply of local talents. There is no doubt, however, that lowering the cost of migrating to Canada would directly increase not only the number but also the average quality of foreign talents coming to this country.

The second type of policy is one that has only an indirect, or marginal, effect on the attractiveness of a country for foreign talents. An example of such a policy is one aimed at allowing the freer movement of domestic entrepreneurs and workers. Moreover, the effect of such a policy depends crucially on the economic environment in which it is introduced. For instance, a policy aiming at improving the international mobility of workers is useful to attract foreign talents and encourage the entry of new firms when the relative cost of labour is high, but not when it is low. However, a policy that allows freer mobility of local entrepreneurs may be far less useful if entrepreneurs choose not to respond to such an option or if, in responding positively, they induce an imperfect substitution between local and foreign talents. Whether or not such a policy is desirable then depends crucially on the relative economic merits of each group of entrepreneurs.

Appendix

The underlying model used in this paper is based on Lucas (1978) and Murphy et al. (1991). Here, we develop a simplified version in order to understand the main forces at work.[6]

In each country, any firm producing a homogeneous product has an entrepreneur with talent level θ and workers, each of whom earns market wage w. We assume that the distribution of abilities is uniform between the lower and the upper limit ($\theta \in [0, \theta_i]$, i = U, C for United States and Canada, respectively). Ability measures how much an individual or entrepreneur is able to exploit the technology he or she operates. Every individual in both countries is fully employed and chooses either to be employed as a worker or to be an entrepreneur. "Ability" is an attribute solely of entrepreneurs and plays no role for workers; rather, as a worker, an individual simply supplies one unit of labour to the market.

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[6] All technical derivations can be found in Schmitt and Soubeyran (2003).

A firm producing in country i earns profits equal to

$$\pi(\theta) = \chi_i \theta f(l) - w_i l. \qquad (1)$$

where χ_i represents a country-specific common state of technology, θ is the entrepreneur's ability, and $f(l)$ is the production function with respect to the number of workers, l, the firm employs (it exhibits decreasing marginal product of labour). The last term of the profit function, $w_i l$, is the firm's total labour cost. The production function is the same for every entrepreneur in both countries, and each entrepreneur takes as given the wage and the state of the technology irrespective of the country in which the firm produces. We also assume that the labour market is competitive in both countries and that the output market is characterized by free trade between two small countries (in the economic sense).

It must be clear from equation (1) that, although all entrepreneurs use the same technology, those with higher ability earn a higher profit than those with lower ability. This increasing return to ability induces able individuals to become entrepreneurs on two counts: they earn a higher profit for a given firm size and they can spread their ability over a larger firm scale. Indeed, given the above assumptions, the number of workers an entrepreneur hires is such that the marginal value product is equal to the marginal cost, and since the marginal value product increases with the entrepreneur's ability, the size of the firm increases with the entrepreneur's ability.

Since an individual chooses to become an entrepreneur when profit is higher than salary or to become a worker when salary is higher than profit, an individual who is indifferent between one choice and the other in country i has ability θ_i^* such that

$$\pi(\theta_i^*) = w_i. \qquad (2)$$

Since profit increases with the entrepreneur's ability, any individual with high ability ($\theta > \theta_i^*$) prefers to be an entrepreneur and any individual with low ability prefers to be a worker.

The critical ability θ_i^* still needs to be determined. Since it splits the domestic agents into two groups, workers and entrepreneurs, it is found simply by equating labour demand and labour supply. In other words, without international mobility,

$$L_i^S(\theta_i^*) = L_i^D(\theta_i^*). \tag{3}$$

Equations (2) and (3) determine, for each country, the market wage w_i and the skill θ_i^* of the individual who is just indifferent between being an entrepreneur or a worker. Hence, these two equations capture how an agent's choice of activity and wage simultaneously adjusts to any exogenous changes. Another way of interpreting equation (2) is that it determines the number of firms in each country, since the number of firms in country *i* is equal to the number of entrepreneurs with ability above θ_i^*.

We now add a foreign pool of talented individuals with a specific distribution of abilities $[\theta_0, \theta_0]$, which is at least as high as the best abilities of the individuals in the two countries. A foreign entrepreneur moving to one of these two countries expects to earn $\pi_i = \chi_i \theta f(l) - w_i l - \delta_i$, where δ_i is the cost of migrating to country *i*.

When workers are mobile between the two countries, the common international wage and the critical ability, θ_i^*, making an individual indifferent between being a worker and an entrepreneur are determined by

$$w_U(\theta_U^*) = w_C(\theta_C^*)$$

and

$$L_U^D(\theta_U^*) - L_U^S(\theta_U^*) = L_C^S(\theta_C^*) - L_C^D(\theta_C^*).$$

The second equation also indicates the pattern of workers' migration between the United States (*U*) and Canada (C).

When entrepreneurs are mobile between the two countries, an entrepreneur migrates when $\pi_i(\theta) - \delta_i \geq \pi_j(\theta)$, where *i* is the country of migration and *j* is the country of origin. Hence, entrepreneurs willing to leave country *j* must have an ability greater than some ability $\tilde{\theta}_j$: only the best entrepreneurs leave a country. The migration of entrepreneurs modifies the supply of labour $(L_i^S(\theta_i^*))$ but equations (2) and (3) are still used to determine the equilibrium in each country.

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Cultural Clustering, Skills, and International Labour Mobility

Dominique M. Gross and Nicolas Schmitt

Reliable statistical information on the phenomenon of brain drain or gain is extremely difficult to find and, when it exists, is available only after long delays and often provides inconclusive or contradictory results. Data on overall migration flows between pairs of countries, however, are more readily available, and even though they do not say much about brain drain directly, some interesting indirect hypotheses can be investigated.

In this essay, we focus on the role of clusters of migrants by their place of origin in receiving countries as a determinant of the destinations of newcomers. We argue that the existence of a community of the same origin contributes to segmenting the labour market, thereby generating options that are more attractive for new migrants. As a consequence, new immigrants may flock to places where nationals of their country are already established.

This essay is based on material contained in Gross and Schmitt (2003). Nicolas Schmitt would like to acknowledge financial support from the Donner Canadian Foundation.

Such clustering occurs because it reduces information costs among culturally alike immigrants, which may permit them to do better than the native born, independently of individual characteristics. Various frameworks may help to explain this advantage. For example, cultural clusters may make it easier, and therefore cheaper, for immigrants than for the native born to identify whether new immigrants are likely to be cooperative or noncooperative in trade relationships (Stark 1995). Lower information costs among culturally alike immigrants then generate a higher proportion of the cooperative type among immigrants than among nonimmigrants (provided each agent deals only with his or her own type). Alternatively, immigrants may operate more efficiently in their community and thus generate an efficiency premium from employers of the same origin (Gross and Schmitt 2003). In other words, repeated interactions among employers and immigrants with common characteristics may help to sustain a higher wage within cultural communities than in the rest of the economy.[1]

Why is this argument relevant for the brain gain issue? Simply, the cultural clustering hypothesis is likely to be more relevant for some types of migrants than for others. Indeed, if it is important at all, it is for low-skilled migrants, since more highly skilled migrants tend to place more weight on individual attributes in their migration decision. Highly skilled migrants may also cluster geographically, but the determinants of their location decisions are likely to be associated more with professional and industry characteristics than with cultural identity. We find that, although the lack of significance of cultural clustering in migration decisions cannot be directly attributed to the skill level of migrants and, thus, to a brain drain, the results are clear enough to indicate that migrants' skills are likely to be a significant source of the difference between cases where cultural clustering matters and where it does not.

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[1] This argument may be associated with the literature on social capital (Krauth 2004; Kolm and Larsen 2003; Ikeda 2002). Lower information costs associated with cultural clustering may also have other benefits, such as shorter periods of unemployment. It should also be noted that higher wages may be indirect, through solidarity and family-based transfers, rather than direct.

To show that common characteristics among immigrants may help to sustain a higher wage within cultural communities than in the rest of the economy, we develop a simple model based on a noncooperative repeated game between employers and immigrants for which the effect of cultural clustering can be tested. Simply, if the quality of information about workers' nonobservable characteristics is endogenous to the size of the market and, thus, the incentive to shirk is endogenous, a high wage is sustainable in a small labour market but not in a large market. Within a given country, such segmentation of the labour market can hold provided informal barriers such as cultural characteristics matter. As a consequence, everything else being equal, and without constraint on settlement location, migrants will have an incentive to cluster. This framework allows for straightforward testing of the role of cultural communities as a determinant of immigration flows. A consequence of our hypothesis is the prediction that the incentive to cluster exists only when the size of these communities is within some range.

The role of cultural clustering in attracting newcomers is broadly supported by analysis of migration flows to major countries that are members of the Organisation for Economic Co-operation and Development (OECD) from the mid-1980s to the mid-1990s. Moreover, the pull that cultural communities exert is specific to certain combinations of source countries and destination countries. In fact, it is significantly weaker for migrations between OECD countries. The result that cultural communities are more attractive for immigrants from non-OECD countries suggests that cultural clustering may be linked to skills. In effect, for migrants between industrialized countries, the information advantage does not matter. Alternatively, the match between the characteristics of jobs and those of workers is closer within the OECD than between non-OECD source countries and industrialized destination countries, and cultural communities do not generate a compensating premium.

The rest of the essay is organized in the following way. The next section provides a summary of the theoretical framework. In the following section, we survey some related empirical results and discuss the links between cultural clustering and skills. In the final section, we draw some conclusions for the brain drain issue.

A Theoretical Framework for Cultural Clustering

People who consider migrating to a new country usually have several choices of destination. These choices, however, are not independent of the structure of the labour market and of perceived job opportunities in possible destinations. For instance, some countries may have relatively small and homogeneous markets for migrants from particular ethnic backgrounds that depend on a specific characteristic such as language. In a country where labour markets are effectively segmented, wages may be higher in small, ethnic-specific submarkets than in the large, anonymous submarket. As a consequence, all else being equal, such migrants have an incentive to cluster in countries that have effective labour market segmentation.

Two characteristics are key elements of the sustainability of segmented labour markets and the existence of different wages in the two types of submarkets: specific job attributes, which naturally generate a segmentation of the market (for instance, the need for contacts with migrants' home countries or language requirements), and the availability of better information in the smaller ethnic submarkets. Given these two characteristics, it may be profitable for employers in the smaller submarkets to offer relatively higher wages because they will elicit higher productivity from their workers despite the risk of shirking.

To understand why this argument holds and why such forces are more likely to matter for migrations from non-OECD to OECD countries than for migrations between OECD countries, consider two groups of potential employers in a host country: a small group from the same cultural background as the new migrant and a large group without defined cultural attributes. The wage in the large labour market is competitive and is the best outside alternative earning in the host country, while the wage offered in the small labour submarket is higher than the large labour market's competitive wage. For given skills, migrants differ in the level of effort they are willing to put into a job. This is not directly observable, however, and upon arrival in the host country a new migrant can always find a job with an employer in the small labour market that pays the higher wage. In a sense, the newcomer gets the benefit of the doubt about individual productivity. Only after the migrant has worked for some time is his or her output observable and the employer knows whether or not the higher wage is deserved.[2]

If the worker turns out to be a shirker and is laid off, the likelihood of his or her finding another high-wage job diminishes depending on the extent to which information about the migrant becomes known to other employers in the small submarket. The quality of that information depends, in turn, on the size of the labour submarket. The larger the submarket, the more difficult it becomes for employers to obtain information about particular workers and the easier it is for a shirker to fool potential employers. It may be possible for a poor performer to earn a high wage for a brief period; indeed, if the migrant cares only about the present, the best strategy is to provide low effort for a high wage upon arrival. The eventual cost of shirking, however, is such that the migrant who cares sufficiently about the future will choose to offer a high level of effort. Employers, for their part, will pay high wages for only as long as the benefit from the migrant's high productivity more than offsets costs, while those in a large submarket, even one in which ethnic characteristics are considered important, will be disinclined to take chances with possible shirkers and will offer a competitive wage instead. Hence, while clusters of culturally alike migrants can form, there is a limit to their effective size.[3]

Does human capital matter in relation to cultural clusters or, equivalently, is cultural clustering equally important for highly skilled and for low-skilled migrants? One way to answer the question is to consider that cultural clusters offer migrants characteristics that are largely substitutes for human capital. In other words, cultural clusters allow migrants to earn rents because they have specific characteristics that differentiate them from workers in the large competitive market, just as human capital in the form of particular skills and training allows individuals to differentiate themselves from others in the broader labour market. Cultural clustering differs from human capital, however, in that the former works as a collective, rather than an individual, attribute. It is therefore likely that those with relatively low human capital will place greater value on cultural clusters than those with relatively high human capital. As a consequence, cultural clustering, as a form of marketable specificity, is likely to emerge among migrants with little human capital rather than among those with a significant level of marketable human capital.

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[2] It is important to note that wages cannot be made contingent on the *ex post* level of output due to lack of an enforcement mechanism.

[3] The nonlinear impact of cultural clustering is analyzed in detail and confirmed empirically in Gross and Schmitt (2003).

Since an aggregate framework aims at explaining flows of migrants, rather than the decisions of individuals, we now must embed the cultural clustering framework into a standard model for immigration flows, which necessitates a somewhat technical explanation. The number of people deciding to migrate (*IFL*) from a source country, *m*, to a destination country, *k*, can be expressed as the product of the probability to migrate, *f*, and the size of the population in the source country, POP_m, of which only a proportion, g_k, is accepted by the destination country. Thus,

$$IFL_{m,k} = f * POP_m * g_k . \tag{1}$$

The segmented labour framework can then be reconciled with a traditional model of migration decisions, which identifies the factors determining *f*. In a model such as the one developed by Harris and Todaro (1970), the decision to migrate depends on the relative expected incomes in both the source and destination countries (y_m, y_k), and other exogenous factors — such as the cost of migrating, *Z*. As shown above, through clustering, new migrants may earn more than the average wage in the destination country, and the expected income in the country of immigration is now made of two components, income from the large competitive market, y_k, and possibly a premium that varies with the size of the cultural community, s_k^m. The share of accepted applicants, g_k, is determined mostly by factors related to the parameters of the immigration policy, V_k. Hence, the flow of migrants, $IFL_{m,k}$, from source country m to destination country k is

$$IFL_{m,k} = h[y_m, y_k, s_k^m, Z, POP_m, V_k]. \tag{2}$$

Thus, when a traditional migration decision framework is augmented by the cultural community effect, a migrant's choice of destination is no longer simply a function of the average relative incomes in the source and destination countries but also of the size of the population from the migrant's home country that is resident in any given destination country, s_k^m, which represents the possibility of earning a premium.

Empirical Implementation and Results

Clearly, equation (2) does not explicitly differentiate between the decisions of highly skilled and less-skilled migrants, mostly because separate observations on aggregate flows of the two categories are not available. Nevertheless, one can draw some general conclusions about agglomeration decisions of the two groups.

Assuming that an unskilled migrant is more likely than a skilled migrant to receive a wage premium for cultural characteristics, one can expect cultural clustering to play a larger role in the unskilled migrant's location decision. In fact, some studies have shown that better-educated immigrants tend to be less geographically concentrated than their less-educated compatriots (see, for example, Izyumov et al. 2002; Newbold 1999). The brain drain phenomenon is, after all, linked to the existence of a world market for some competencies, rather than to specific communities. This observation implies that cultural clustering is more likely to happen in destination countries in which immigrants are, on average, less skilled, which raises the following question: Do combinations of source and destination countries exist for which the cultural effect is irrelevant and, if so, are those combinations likely to involve flows of migrants with higher skill levels?

We can investigate this question by testing the role of cultural agglomeration for migrations between OECD countries. Although information on the skill content of migration flows is scant and not directly comparable (see for example, Guellec and Cervantes 2001), a recent collection of country studies (OECD 2001) provides some evidence to support the hypothesis that people who migrate from one OECD country to another tend to be more highly skilled than those who migrate from the rest of the world to OECD countries. For example, as Table 1 shows for immigrants to the United States between 1990 and 1996, only 3 percent of those from China and 12.9 percent from the Philippines were highly skilled. Of immigrants from India, 24.7 percent were highly skilled, although that percentage is likely to have risen in more recent years as a result of the rising demand for highly skilled workers by the information technology sector and changes in US immigration policy.[4]

In contrast, 72.7 percent of newcomers to the United States from Australia over the 1994–2000 period were highly skilled. Similarly, 91.1 percent of US and 86.8 percent of Canadian immigrants to France from 1990 to 1996 were highly skilled. Gaillard (2001, figure 3) reports that, except for refugees from the former Yugoslavia, the largest contingents of science and technology workers entering Sweden between 1987 and 1998 were all from OECD countries. Additional supporting evidence can be found in the percentage of immigrants employed in highly skilled occupations in sample EU countries in 1998, shown in Table 2. In every case, the percentage

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[4] The number of H1-B visas the United States issued to skilled workers from some developing countries, including India, rose from fewer than 40,000 during the 1992–95 period to almost 150,000 during the 1996–99 period (Martin 2001, table 3).

Table 1: ***Skill Distribution in Flows of Permanent Migrant Workers***

	Total	Highly Skilled	Share of Highly Skilled
			(%)
1990–96: to the United States from			
China	300,500	9,153[a]	3.0
India	267,200	65,989	24.7
Mexico (1992–96)	705,300	15,256	2.2
Philippines	412,300	53,049	12.9
Russia (1992–96)	70,500	7,239	10.3
1990–96: to France from			
European Union	43,980	18,168[b]	41.3
Japan	2,773	2,408	86.8
United States	5,132	4,673	91.1
Canada	1,204	999	83.0
Total	157,548	38,571	24.5
1994–2000: from Australia to			
Europe	19,456	12,429[c]	63.9
Germany	2,677	1,933	72.2
France	1,934	1,369	70.7
Japan	7,418	5,855	78.9
United States	31,199	22,686	72.7

[a] Defined as those holding an H-1B visa, which requires at least a university first degree. The total is for all types of permanent settlers (authors' calculations from Martin 2001, table 3; OECD 2001).

[b] Consists of "cadres et techniciens" (managers and technicians); the EU data do not include Portugal (OMI, various years).

[c] Consists of "managers, professionals, and para-professionals" (authors' calculations from Hugo 2001, tables 12–13).

from developed countries is substantially higher than that from developing countries.

Although it is not possible to compute correlation statistics because of a lack of consistent observations across countries and time, the evidence suggests there is a relationship between the country of origin and the skill content of immigration flows to OECD countries, and that flows between OECD countries are much more highly skilled than flows from other countries to OECD countries. Furthermore, this relationship enables us to draw some inferences

Table 2: ***Employment of Immigrants in Highly Skilled Occupations, Selected EU Countries, 1998***

	Source of Immigrants		
	Other EU and Developed Countries	**Developing Countries**	**Total (incl. Nationals)**
		(thousands)	
Austria	61 *(1.7%)*	0	3,626
Belgium	89 *(2.3%)*	10 *(0.3%)*	3,857
France	155 *(0.7%)*	89 *(0.4%)*	22,469
Germany	486 *(1.4%)*	132 *(0.2%)*	35,537
Netherlands	74 *(1.0%)*	14 *(0.2%)*	7,401
Sweden	46 *(1.2%)*	0	3,946
United Kingdom	361 *(1.3%)*	97 *(0.4%)*	26,882

Note: "Highly skilled" as defined by the International Labour Organization, International Standard Classification of Occupations, ISCO 1-3.

Source: Authors' calculations from Auriol and Sexton 2001, table 4.

from a possible difference in the role of cultural communities in attracting new migrants from various source countries.

Our observations measure the number of people from particular source countries that legally entered one of the sample OECD countries between 1988 and 1996. In all, our sample contains 134 immigration flows from anywhere between six and twelve sources — representing a wide variety of cultures and countries, both OECD and non-OECD — to twelve destination countries (see Table 3). Furthermore, as Table 4 shows, there is a wide variation in the mix of immigrants from OECD and non-OECD countries. For example, countries such as Canada and the United States, which have a long tradition of immigration based on factors other than ethnic background,

Table 3: *Sample Destination and Source Countries*

Destination Country	Source Countries
Australia	China, Fiji, Hong Kong, India, Malaysia, New Zealand,[a] Philippines, South Africa, Taiwan, United Kingdom,[a] United States,[a] former USSR, Vietnam, former Yugoslavia
Canada	China, Hong Kong, India, Philippines, Poland,[a] Sri Lanka, Taiwan, United Kingdom,[a] United States,[a] Vietnam
United States	Canada,[a] China, Colombia, Cuba, Dominican Republic, El Salvador, Haiti, India, Jamaica, Mexico,[a] Philippines, Poland,[a] South Korea, former USSR, Vietnam
Belgium	Democratic Republic of Congo, Italy,[a] Morocco, Portugal,[a] Spain,[a] Turkey,[a] former Yugoslavia
France	Algeria, Morocco, Poland,[a] Tunisia, Turkey,[a] former Yugoslavia
Germany	Greece,[a] Hungary, Italy,[a] Morocco, Portugal,[a] Romania, Spain,[a] Turkey,[a] United States,[a] former Yugoslavia
Hungary	China, Germany,[a] Greece,[a] Israel, Poland,[a] Romania, Russia, Slovakia, Ukraine, United Kingdom,[a] Vietnam, former Yugoslavia
Japan	Brazil, Canada,[a] China, Germany,[a] Peru, Philippines, South Korea,[a] Taiwan, Thailand, United Kingdom,[a] United States[a]
Netherlands	Belgium,[a] France,[a] Germany,[a] Italy,[a] Morocco, Poland,[a] Suriname, Turkey,[a] United Kingdom,[a] United States[a]
Norway	Denmark,[a] Germany,[a] Iran, Pakistan, Philippines, Poland,[a] Somalia, Sri Lanka, Sweden,[a] Turkey,[a] United Kingdom,[a] United States,[a] former Yugoslavia
Sweden	Chile, Denmark,[a] Ethiopia, Finland,[a] Iraq, Iran, Lebanon, Norway,[a] Poland,[a] Turkey,[a] United Kingdom,[a] United States,[a] former Yugoslavia
Switzerland	Austria,[a] Canada,[a] France,[a] Germany,[a] Italy,[a] Netherlands,[a] Portugal,[a] Spain,[a] Turkey,[a] United Kingdom,[a] United States,[a] former Yugoslavia

[a] Destination and source country are both OECD members — Mexico since 1994, Hungary, Poland, and South Korea since 1996.

Table 4: ***Share of Sample Immigrants from OECD and Non-OECD Source Countries, 1988–96***

Destination Country	Source Country Non-OECD	OECD
	(percent)	
Australia	60.8	39.2
Canada	92.9	7.1
United States	92.0	8.0
Belgium	48.7	51.3
France	93.3	6.7
Germany	18.3	82.7
Hungary	89.9	10.1
Japan	65.4	34.5
Netherlands	31.5	68.4
Norway	39.2	61.8
Sweden	42.0	58.0
Switzerland	32.0	68.0

Note: Hungary became a member of the OECD during the last year covered by the sample.

have a much smaller share of immigrants from OECD countries (7.1 percent and 8 percent, respectively) than do European members of the OECD.[5] These characteristics suggest that we have enough statistical information to test the relevance of cultural communities for migration between OECD countries as well as from the rest of the world to OECD countries.

Following equation (2), the explanatory variables include income per capita in the source country, $y_{m,t}$, and in the destination country, $y_{k,t}$, which enables us to capture the relative average financial attractiveness of migrating. The additional advantage that may be gained from working in a culturally alike environment, *cultural* $cluster_{k,t}$, is captured by the share of residents from the same culture in the foreign population of the destination country.[6] Hence, income per capita captures the average opportunities, while the cultural variable captures the possibility of higher rewards. In addition, the level of population in the source country, $pop_{m,t}$, and in the destination country, $pop_{k,t}$, captures the size effect and the probability of being accepted in a given destination country. We approximate changes in immigration policies in receiving countries by a time trend and a trend squared. Finally, since some destination countries included in their statistics the temporary immigration of refugees from the former Yugoslavia during the period of strife in that region between 1991 and 1995, we introduce a dummy variable, *Boswar*. These immigrants benefited from a special status, which was to be accepted for an unknown length of time but on a temporary basis.

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[5] The OECD countries are Canada, the United States, Finland, Norway, Poland, Denmark, the United Kingdom, Germany, and France. The former Yugoslavia comes second behind Canada and the United States combined.

The basic estimated specification is in log, *L*, except for the percentage variable, such that

$$\begin{aligned} LIFL_{m,k,t} = {} & c_{m,k} + \alpha_1 Lpop_{m,t} + \alpha_2 Lpop_{k,t} + \alpha_3 Ly_{m,t} + \alpha_4 Ly_{k,t} \\ & + \alpha_5 Cultural\ cluster_{k,t} + \alpha_6 Time + \alpha_7 Time^2 + \alpha_8 Boswar + e_{m,k,t} \,. \end{aligned}$$

We use a standard technique for panel data, including a fixed effect, $c_{m,k}$, for each combination of immigration flow and destination country that accounts for factors specific to each pair of countries, such as special ties due to former colonial relations or a common language. To avoid zeros, we sum annual flows for three subperiods, 1988–90, 1991–93, and 1994–96. We present the results in Table 5.

Our general hypothesis that the size of the community of the same origin in the destination country matters is clearly supported

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[6] A source country can have many different cultures depending on how narrowly one defines "culture." It is also a fact, however, that, in some countries where ethnic communities are very small, these differences tend to matter less and people from the same country cluster together. Hence, we use the population from the same country of origin as the measure of "cultural clustering," which is also the standard approach in the literature on networks (see Gross and Schmitt 2003).

Table 5: ***The Role of Cultural Clustering in Immigration Flows***

	$LIFL_{m,k,t}$ (1)	$LIFL_{m,k,t}$ (2)	$LIFL_{m,k,t}$ (3)	$LIFL_{m,k,t}$ (4)
$Ly_{k,t}$ (destination)[a]	.181 (0.3)	.207 (0.3).	171 (0.3)	.237 (0.4)
$Ly_{m,t}$ (source)	-.408 (1.7)	-.402 (1.6)	-.410 (1.7)	-.445 (1.8)
$Lpop_{k,t}$ (destination)	.924 (1.5)	.923 (1.5)	.966 (1.6)	.896 (1.5)
$Lpop_{m,t}$ (source)	-1.076 (1.7)	-.967 (1.5)	-1.018 (1.6)	-1.140 (1.7)
Time	.437 (2.5)	.418 (2.4)	.442 (2.5)	.416 (2.3)
$Time^2$	-.125 (3.2)	-.122 (3.1)	-.128 (3.3)	-.120 (3.1)
Cultural cluster$_{k,t}$	.037 (2.0)	.044 (2.1)	.039 (2.0)	.032 (1.4)
Boswar	.666 (2.5)	.663 (2.4)	.730 (2.6)	.662 (2.4)
*EU*Cultural cluster*$_{k,t}$			.014 (1.2)	
*OECD*Cultural cluster*$_{k,t}$		-.030 (2.2)		.008 (0.3)
*OECD*AUS-CAN-USA* Cultural cluster*$_{k,t}$				-.059 (1.8)
*AUS-CAN-USA*Cultural cluster*$_{k,t}$				.147 (2.4)
Adjusted R^2	.934	.934	.934	.935
N (d.f.)	402 (260)	402 (257)	402 (259)	402 (259)
F-test (H_0:$c_{m,k} = c$)[b]	12.7 (.00)	12.7 (.00)	12.6 (.00)	11.4 (.00)

[a] Absolute t-values in parentheses. Calculated from heteroscedastic-consistent standard errors. The critical values are 1.28, 1.65 and 2.33 at 10%, 5% and 1% significance, respectively, for one-tail tests.

[b] The hypothesis is that all intercepts are equal vs fixed-effect model. The Hausman test of H_0: Random effect vs fixed effect is $\chi^2(5) = 6.52$ and the random effect model is rejected. P-values are in parentheses.

Source: Gross and Schmitt 2003.

by the empirical results (shown in column 1 of Table 5). Indeed, we find that each percentage point increase in the stock of the culturally similar resident population increases the flow of newcomers by about 0.04 of a percentage point, a result consistent with that of Zimmermann (1996), who finds a network effect for broadly defined regions in the case of asylum seekers in European countries.

In the next step, we must determine whether cultural communities are uniformly relevant for OECD and non-OECD source countries. Starting from the hypothesis that the migration of highly skilled people occurs because of better job opportunities for a given skill level and not because of some cultural advantage, one can infer that, for migrations between OECD countries, which tend to be dominated by highly skilled people, only relative average income matters. Hence, we introduce an additional dummy in the specification, *OECD*, which takes the value of 1 when both the source and destination countries are OECD members and zero otherwise. We then interact this variable with the *cultural cluster*$_{k,t}$ variable. In column 2 of Table 5, the coefficients of the cultural variable and that of the interacting *OECD* dummy are close in value with opposite signs. This result implies that the general clustering effect is cancelled for OECD source countries — that is, the appropriate t-test = 0.9 confirms that the absolute values are not significantly different — and that immigration flows between OECD countries are insensitive to the presence of cultural communities. Note that, when the set of countries is limited to members of the EU (column 3), the same result holds.

From these estimations, we can conclude that, although the existence of a cultural community is a factor of agglomeration for migrants from developing to developed countries, the same is not true for migrants from one developed country to another. Put another way, cultural ties are less important for migrants between developed countries than for migrants from developing to developed countries. We interpret this as evidence of the existence of a better match between skills and labour market characteristics in developed countries, which is typical of global markets that encourage a brain drain effect.

We can test the robustness of this result by exploiting another feature of the dataset. The nature and goals of the immigration policies of the destination countries in the sample are quite different. In particular, the three major traditional immigrant-receiving countries — Australia, Canada, and the United States — have active immigration policies, unlike those of European countries and Japan. Do our results hold independently across the two sets of countries, even though flows to Australia, Canada, and the United States are dominated by immigrants from developing countries?

To answer this question, we conduct the same exercise as before but introduce the dummy variable *AUS-CAN-USA* and interact it with the *cultural cluster*$_{k,t}$ variable. We also compare the *AUS-CAN-US* and *OECD* variables. The results (Table 5, column 4) show that cultural communities matter in all destination countries but much more so when the destination is one of the three traditional immigrant-receiving countries. Also, the cultural clustering effect is much stronger in those countries for migrants from developing countries.

To summarize, the existence of cultural communities in a destination OECD country may offer a labour market advantage to those who migrate there from a developing country, but not to migrants from other developed countries. Given the correlation between the skill content of migrant flows and the source country, one can infer that the presence of a cultural community does not play a role in the location decisions of skilled migrants. This finding is consistent with the existence of a world market for highly skilled labour and the ensuing consequences for the brain drain phenomenon.

Conclusion

It is often observed casually that migrants tend to cluster in groups that are ethnically homogenous. We have shown that, although this observation is empirically correct, it tends to apply more to less-skilled migrants than to those who are highly skilled. One reason for this clustering is that the existence of segmented, culturally specific labour markets in immigrant-receiving countries allows for higher wages to be paid to new arrivals than they would receive in the general labour market, where the lack of complete information about individuals inhibits employers from taking chances with potentially underperforming workers. Our cross-country empirical analysis supports the role of cultural communities in attracting new migrants except when the source and destination countries are OECD members. Also, the clustering effect is much stronger in

Australia, Canada, and the United States — reflecting the long-standing immigration objectives of these countries — than in Europe or Japan.

That very different clustering effects exist for migrants from developed countries and for those from the rest of world suggests that clustering is a response to some migrant characteristics with respect to the job market. Differences in migrants' skills are the most likely source. Simply, because of their ability to compete in the world market for employment, skilled migrants need the support of cultural communities less than do unskilled migrants.

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Labour Mobility and a North American Common Market:
Implications for Canada

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One hallmark of a true common market is labour mobility. The North American Free Trade Agreement (NAFTA) is not a common market, of course, but it does contain some provisions on labour mobility. In particular, the extremely successful US TN visa program allows the temporary migration of business people and professionals. Otherwise, migration within NAFTA is limited, and all three NAFTA countries view traditional immigration controls as instruments of national social and economic policy.

To the extent that there has been much discussion within NAFTA on migration, it has largely focused on the movement of Mexicans northward into the United States. Here in Canada, the discussion has revolved around the movement of highly skilled individuals southward. There has been almost no discussion, however,

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of moving toward a common continental labour market with mobility rights for all NAFTA workers. In contrast, one of the central features of the European Union is its single-market program and the free mobility of labour. This has led to a new and growing literature on the consequences of increased labour mobility for labour markets, economic growth, trade, investment, and social policy.

Crossborder Labour Mobility: An Issue of Growing Importance

Although labour mobility is not currently high on the policy agendas of the NAFTA countries, the issue is likely to become increasingly important as deeper North American integration evolves, with or without the help of governments, for several reasons.

First, the growth in both goods and services trade is expanding rapidly among the three countries. Given the potential size of this market, it is reasonable to assume that the after-market and complementary aspects of most services activities often are both firm and place specific, in the sense that customers want to be serviced in their home locations. The United States' existing TN visa program goes partway toward meeting these needs, but opening borders completely to these types of labour flows would facilitate better integration of services markets and promote the growth of Canadian services exports to the United States.

Second, since multinational enterprises (MNEs) routinely wish to move staff across borders for short-term work assignments, the ease with which they can do so affects foreign direct investment (FDI) decisions. Thus, making it easier for MNEs to move staff between Canada and the United States could help to remove the bias against Canadian locations for North American-based FDI.

Third, in many areas of business, virtual labour mobility is already a substitute for physical labour mobility. For example, the call centres that exist in various Canadian cities to serve the entire NAFTA market provide, in essence, a form of mobile labour service. As another example, the Internet has dramatically enhanced the ability of firms and individuals to deliver labour services via digital-based telecommunication networks, giving rise to the vision of a continental e-labour market. Still other examples include doctors located in one city who perform surgery in another and university professors who deliver courses via Distance Learning Technology.

Fourth, serious concerns in Canada about the loss of highly skilled workers to the United States, particularly in high-technology areas, may lead to public resistance to initiatives to further ease the movement of workers between the two countries.

Fifth, border controls are becoming increasingly difficult to enforce without impeding other forms of commerce, yet business demands to expedite crossborder business visits, as well as flows of goods and services, are increasing. The appeal of reducing border costs, however, carries with it a cost: the growing inability to control illegal immigration and perform necessary security checks. At the same time, in the post–9/11 era, the conflict between crossborder mobility and security is increasingly evident.

Finally, the increasing average age of the Canadian population presages future labour shortages in this country. Although such shortages, in turn, may increase the demand for more immigrants, some of these pressures could be met by improving labour mobility within NAFTA.

Welfare and Labour Market Integration

What are the welfare and efficiency consequences of taking NAFTA from a free trade area to an arrangement in which there is full mobility of labour? The standard economic view is that the greater the increase in the degree of mobility, the larger the efficiency gains. Different theories give rise, however, to quite different predictions of the potential welfare gains. In some models, countries lose when the mobility of factors such as labour are increased. In almost all theories, distributional consequences are negative for some groups and positive for others. Robert Mundell argued many years ago (1957) that, within one well-known model of international trade, allowing for the mobility of factors was irrelevant for economic efficiency. NAFTA has certainly moved us a long way toward free trade. Does that imply that the efficiency gains from increased labour mobility are negligible?

In seeking to address this and related questions, we must add the important caveat that, in this paper, we do not explore the complex social and fiscal policy implications of formal labour market integration. Within a true common market, there is labour mobility but not necessarily citizenship mobility, which comes only with more formal political integration. Thus, in the absence of political union, an individual's rights to social and transfer programs may be defined by citizenship and may not be available outside his or her home country — indeed, in both Canada and the United States, most citizenship rights currently go more or less in hand with residency. Increasing labour mobility, therefore, may not necessarily imply access to local social programs and public goods for noncitizens; for example, in Switzerland an individual who leaves his or her home canton to take up work in another canton is not entitled to access to social programs in that canton. Free mobility of labour within NAFTA, therefore, would not necessarily imply that someone who moves from one country to another for work would have access to the social services generally available to citizens.

The essay proceeds as follows. In the next section, we discuss recent trends in international labour flows and some historical data. In the following section, we review theories of international factor movements, and amendments to deal with a number of medium-term considerations such as uncertainty, labour market rigidities, and short-run factor specificity. We also draw out the implications of these theories should Canada-US labour market integration proceed. We then deal with the implications of increased labour mobility for regional and industrial structures, looking in particular at the question of whether increased labour mobility could lead to a pattern of economic development in North America that would be biased against Canada, given the existence of continental free trade.

We then move on to discuss some dynamic factors, including those surrounding the brain drain debate; new forms of labour mobility, including temporary workers and virtual labour mobility; and the macroeconomic adjustment implications of labour mobility and the lessons that can be drawn from European and US experience. In the final section, we offer some conclusions and possible policy implications of these developments for future Canada-US integration and NAFTA.

Trends in Migration and Mobility

Historical Canadian census data show that rates of permanent out-migration are currently near an all-time low and that, for a long time, Canada has enjoyed a net inflow of permanent migrants.[1] At one time, however, particularly between 1870 and 1901, there were large flows of people from Canada to the United States, as Table 1 shows. Since then, however, immigration has usually exceeded emigration in Canada (an exception was during the Great Depression). The early postwar period also saw large flows from Canada to the United States, but relatively little reverse migration (Tables 2 and 3).

The current debate on the brain drain from Canada to the United States nevertheless has attracted a great deal of media attention, and researchers have made a number of attempts to estimate this flow more accurately. In one such attempt, Finnie (2001) suggests that the number of tax filers leaving Canada each year to all destinations increased steadily from about 15,360 in 1991 to 28,870 in 1997, with an average of about 21,700 per year over the period. In summarizing his evidence, Finnie says that

> 178,000 people left Canada to go to the U.S. between 1991 and 1996, and past experiences indicate that 126,000 of these would be expected to remain permanently in the United States and 52,000 to return to Canada. Emigration to the U.S. was, furthermore, 30 percent higher in this period than from 1986 to 1991, [with] permanent migration increasing by 15 percent and temporary migration doubling. (2001, 3.)

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[1] For many years, annual immigration rates have been between 0.5 and 1 percent of the population, while annual emigration rates have ranged between 0.2 and 0.3 percent of population.

Table 1: ***Canadian Population and Growth Components, 1851–1996***

Period	Net Natural Increase	Immigration	Emigration	Emigration / Immigration	Census Population, end of Period
	(thousands)	*(thousands)*	*(thousands)*	*(ratio)*	*(thousands)*
1851–61	611	352	170	0.48	3,230
1861–71	610	260	411	1.58	3,689
1871–81	690	350	404	1.15	4,325
1881–91	654	680	826	1.21	4,833
1891–1901	668	250	380	1.52	5,371
1901–11	1,025	1,550	739	0.48	7,207
1911–21	1,270	1,400	1,089	0.78	8,788
1921–31	1,360	1,200	971	0.81	10,377
1931–41	1,222	149	241	1.62	11,507
1941–51	1,972	548	379	0.69	13,648
1951–56	1,473	783	184	0.24	16,081
1956–61	1,675	760	278	0.37	18,238
1961–66	1,518	539	280	0.52	20,015
1966–71	1,090	890	427	0.48	21,568
1971–76	931	1,053	492	0.47	23,518
1976–81	977	771	366	0.47	24,900
1981–86	987	677	360	0.53	26,204
1986–91	987	1,199	279	0.23	28,111
1991–96	908	1,170	230	0.20	29,959

Source: Helliwell 2000, table 2.

One of the interesting trends since the implementation of the Canada-U.S. Free Trade Agreement (FTA) in 1989 has been the shift toward temporary forms of migration from Canada to the United States. Of particular interest is the dramatic increase in the number of people using the TN visa program (see Table 4). Although, for a number of reasons, TN visas are thought to be unreliable as an indicator of permanent migration flows, the dramatic increase in their use is undoubtedly indicative of increased interactions of Canadians in the US labour market in some form. Likewise, as Table 4 shows, the number of MNE employee transfers has also been

Table 2: *Immigration between Canada and the United States*

Years	Average Annual Flows
	(thousands)
	Canadian-Born Emigrants to the United States, 1961–98
1961-1970	41.3
1971-1980	17.0
1981-1990	15.7
1991-1996	16.2
1991-1998	14.1
	US Emigration to Canada, 1951–2000
1951-1960	10.1
1961-1970	16.7
1971-1980	17.9
1981-1990	7.9
1991-1994	7.1
1991-2000	6.1

Source: Authors' calculations based on data from Citizenship and Immigration Canada and the US Immigration and Naturalization Service.

Table 3: *The Flow of Non-Immigrant Professional Workers and Their Families from Canada to the United States, 1989–98*

	Professional Workers under FTA (TC)	Spouses and children of FTA workers	Professional Workers under NAFTA (TN)	Spouses and children of FTA workers (TD)
	Canada-US Free Trade Agreement			
1989	2,677	140		
1990	5,293	594		
1991	8,123	777		
1992	12,531	1,271		
1993	16,610	2,386		
			North American Free Trade Agreement	
1994			19,806	5,535
1995			23,904	7,202
1996			26,987	7,694
1997			n.a.	n.a.
1998			59,061	17,816

Sources: US Immigration and Naturalization Service; various statistical yearbooks.

Table 4: ***The Flow of Temporary Workers to the United States under the FTA and NAFTA, 1989–98***

	Categories[a]				
	Traders	**Investors**	**Intracompany Transferees**	**Professionals**	**Total**
1989	24	27	867	1,741	2,659
1990	18	27	1,297	2,756	4,098
1991	11	28	1,139	3,466	4,644
1992	3	29	1,101	3,673	4,806
1993	5	16	1,090	4,348	5,459
1994	6	12	1,474	5,109	6,601
	(0)	*(0)*	*(7)*	*(19)*	
1995	7	22	1,333	5,082	6,444
	(0)	*(0)*	*(15)*	*(66)*	
1996	5	11	1,299	6,240	7,555
	(0)	*(3)*	*(15)*	*(88)*	
1997	6	18	1,633	7,572	9,229
	(1)	*(2)*	*(25)*	*(69)*	
1998	5	22	1,922	8,502	10,451
	(1)	*(0)*	*(42)*	*(96)*	
1999	11	14	1,734	7,331	9,090
	(4)	*(2)*	*(44)*	*(77)*	

[a] Temporary workers who qualify in these categories are business persons who require an employment authorization but are exempt from labour market assessment (employment validation). Business visitors are not included since an employment authorization is not required.

Note: The numbers are based on persons, not on employment authorization documents. The numbers in parentheses indicate workers coming to Canada from Mexico.

Source: Unpublished data provided by Citizenship and Immigration Canada.

rising at a rapid rate, representing both the increased importance of FDI in the economy and the shift toward shorter-term assignments for MNE employees.

Canadian Interprovincial Migration: A NAFTA Template?

In thinking about improving the mobility of workers in the NAFTA context, it is useful to review Canadian interprovincial migration, which, since it is a right of all Canadians, provides some evidence on what might be expected should barriers to the movement of people between Canada and the United States be removed.

Rosenbluth (1996) finds that approximately 1 percent of Canada's population migrates between provinces each year, a large amount relative to the annual increase in the total population. Indeed, Gunderson (1994) says that regional migration is of greater significance to Canada than immigration from abroad. He finds that two-thirds of all migration into and within Canada is regional, ranging from 40 percent in Quebec to 94 percent in the Northwest and Yukon Territories.

In general, an increase in provincial demand for labour leads to an increase in in-migration and a decrease in out-migration. Yet considerable barriers to labour mobility still exist in Canada. Gunderson (1994) cites two kinds: natural and economic barriers (such as distance, culture, and language) and artificial barriers (such as professional and trade licensing and educational and language requirements). Global competition, free trade, technical change, and industrial restructuring have heightened the importance of reducing these barriers so that a strong and competitive Canadian economy can allocate labour more efficiently.

As Table 5 suggests, flows of labour tend, not surprisingly, to be from low-wage, high-unemployment regions to higher-wage, low-unemployment regions. Moreover, the flows are negatively affected by distance. Mobility also tends to be higher among younger people, since the young have a longer period in which to benefit from the move, experience less family disruption, and, typically, have lower

Table 5: ***Domestic and International Migration, Canada, 1994–2000***

		Number by Source		Percentage by Source	
	Total Immigration	**Other Provinces**	**Other Countries**	**Other Provinces**	**Other Countries**
Canada	3,553,298	1,469,023	2,084,275	41.3	58.7
British Columbia	728,810	302,397	426,413	41.5	58.5
Alberta	557,437	97,133	460,304	17.4	82.6
Saskatchewan	135,428	12,926	122,502	9.5	90.5
Manitoba	134,632	26,686	107,946	19.8	80.2
Ontario	1,310,240	800,292	509,948	61.1	38.9
Quebec	355,242	200,364	154,878	56.4	43.6
New Brunswick	84,900	4,839	80,061	5.7	94.3
Nova Scotia	131,803	18,621	113,182	14.1	85.9
Prince Edward Island	20,372	1,084	19,288	5.3	94.7
Nfld. & Labrador	57,401	3,452	53,949	6.0	94.0
Yukon	12,795	575	12,220	4.5	95.5

Sources: Human Resources Development Canada; authors' calculations.

forgone wages. Finnie (1999) reports that, over the 1982–95 period, no less than 7.4 percent of the Canadian population moved from one province to another, with one-time movers representing 4.5 percentage points, multiple movers 1 percentage point, and returnees 1.9 percentage points. Overall, annual rates of provincial out-migration held constant at 1.5 percent of the population through most of the 1980s, then fell to 1.2 percent by the mid-1990s for all provinces except Newfoundland and Labrador, where the rate remained higher. Finnie argues that this apparently small drop actually indicates a downward structural shift in interprovincial migration rates. The Atlantic and Prairie provinces had the highest rates of out-migration relative to their populations, and their out-migrants tended to go to the larger, nearby provinces of Ontario, Quebec, and British Columbia. Mobility in and out of Quebec was relatively lower than for most provinces, probably due to language and cultural differences.

Trade and Migration: Theories and Implications

Over the past 25 years, although world trade and investment flows have been considerably liberalized, the mobility of people has remained steady, particularly relative to earlier periods in history. During the first great era of globalization in the decades prior to World War I, immigration from Europe to the New World and within Europe itself occurred on a vast scale (see, for example, O'Rourke and Williamson 2000). Some 60 million Europeans moved to the resource-rich and labour-scarce Americas in the century following 1820, three-fifths of them to the United States; in the 1890s, even more Italians emigrated to France and Germany than to the United States. This migration had profound effects on many countries. For example, between 1870 and 1910, it swelled the United States' labour force by 24 percent and cut Ireland's by 45 percent. Moreover, just as trade caused global commodity prices to converge, so mass migration contributed to the convergence of wage levels.

In the new era of globalization since 1980, however, although trade has been growing about twice as fast as economic output, migration flows have been relatively stable. Economists naturally are concerned with both the positive and normative implications of labour migrations, policy induced or otherwise, and changes in the labour mobility regime — such as the formation of common markets. For the purposes of this paper, we assume that NAFTA approximates a classic free trade area, including free movement of capital, even if it does little to facilitate the international mobility of workers. Has the emergence of greater trade flows within NAFTA increased or decreased migration pressures within the NAFTA countries? Alternatively, does increased labour mobility tend to increase or decrease trade?

These questions can be addressed in a number of ways. One familiar line of attack is to ask whether labour migration and international trade are substitutes or complements in terms of achieving a given pattern of economic output and welfare. If they are substitutes, for example, then freer trade ought to reduce migration pressures.

Economic theory is, however, ambiguous on the answer to this question. Theories emphasizing that trade is driven by differences in relative supplies of factors of production tend to argue that trade and migration are substitutes: countries that need to import labour-intensive goods can achieve the same outcome by trading less and by "importing" workers. In the NAFTA context, that Mexico has a huge abundance of unskilled labour carries the obvious and important implication that imports from Mexico will be in labour-intensive production activities and that this trade is, in part, a substitute for increased migration of Mexican labour to the north. On the other hand, theories in the Ricardian tradition, which emphasize that trade reflects relative productivity differences across countries, predict that factor movements tend to increase trade by reinforcing the initial patterns of comparative advantage: workers move from where their productivity is low to where it is high. Some recent theories emphasize a third set of linkages: the role of network effects among immigrants and their home-country contacts, which tend to be trade creating.

Complements or Substitutes?

Theory, therefore, does not tell us whether greater labour mobility within NAFTA would increase or decrease crossborder trade. Is there any empirical evidence one can appeal to on this question? Unfortunately, the literature on the relationship between trade and migration is relatively sparse, and little of it deals with the difficult issue of causality. Some positive and significant relationships between trade and immigration have, however, been found. Head and Ries (1998) estimate that a 10 percent increase in immigrants to Canada leads to an increase of 1 percent in exports and 3 percent in imports, while Head, Ries, and Wagner (1998) find that immigration-creating trade networks might explain as much of 10 percent of Canadian trade over the first half of the 1990s.[2]

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[2] See also Gould (1994) for a study of the US context.

Trade is commonly thought to be a major factor driving new FDI. The more important FDI is in the economy, the more likely it is that there will be increased demands for highly specialized workers to provide transactions services within firms.[3] Certainly, within members of the Organisation for Economic Co-operation and Development (OECD), there is a strong connection between FDI and trade. Fontagné (1999), for example, finds that each dollar of outward FDI from OECD countries increases exports by two dollars. The overall relationship between trade and migration, therefore, may depend in part on the role of FDI as a force for trade creation. For example, Globerman (1999) finds some evidence that closer links between trade and FDI links are driving the increased migration of specialized workers from Canada.

The European Union — as an example of the relaxing of migration rules once free trade has been reached — is probably the most interesting recent case relevant to NAFTA. Indeed, the 1992 Single Market Program, which introduced free labour mobility within the EU, followed a long process of trade liberalization. By all accounts, however, the 1992 changes have produced very little movement of people within the EU, which suggests that trade and migration have become substitutes in that region (and in its predecessor, the European Community; see Straubharr 1988).

Table 6 illustrates the substitution effect of trade and migration for six EU countries over the 1988–97 period. Although migration takes time to adjust to the elimination of restrictions, migration within the EU as a proportion of all migrants remained quite stable after the introduction of the Single Market Program in 1992 compared with previous years, and its share with respect to total population has been very low.[4] Of course, "distance" and the presence of different cultures may be important factors restricting migration within the EU, which Krueger (2000) does not expect will change

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[3] FDI in this case is mainly intended for the provision of such services, not for production in another country. Hence, FDI and trade here are complements, an outcome often found in the empirical literature.

[4] The proportion of EU citizens migrating to other EU countries tends to be larger in smaller countries, but it has remained stable.

Table 6: *Inflows of Foreign Population, Selected EU Countries, 1988–97*

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
					(thousands)					
Belgium										
Total	38.2	43.5	50.5	54.1	55.1	53.0	56.0	53.1	51.9	49.2
From EU (%)	52	52	49	46	49	50	48	50	55	56
Denmark										
Total	n.a.	n.a.	15.1	17.5	16.9	15.4	15.6	33.0	24.7	n.a.
From EU (%)[a]			15	15	16	20	24	13	16	
France										
Total[b]	44.0	53.2	102.4	109.9	116.6	99.2	69.3	56.7	55.6	80.9
From EU (%)	n.a.	n.a.	11	11	22	15	16	14	13	8
Germany										
Total	648.6	770.8	842.4	920.5	1,207.6	986.9	774.0	788.3	708.0	615.3
From EU (%)	22	18	17	16	12	14	20	23	24	25
Luxembourg										
Total	8.2	8.4	9.3	10	9.8	9.2	9.2	9.6	9.2	9.7
From EU (%)	85	82	82	78	72	77	77	73	n.a.	n.a.
Netherlands										
Total	58.3	65.4	81.3	84.3	83	87.6	68.4	67	77	76.7
From EU (%)	27	24	23	25	27	23	23	22	25	27
Sample of 6 EU countries										
Total foreign inflow as % of population	0.65	0.8	0.6	0.59	0.75	0.62	0.45	0.45	n.a.	n.a.
EU migrants as % of population	0.2	0.21	0.13	0.12	0.13	0.11	0.12	0.13	n.a.	n.a.

[a] Includes Finland and Sweden from 1995.

[b] From 1990, spouses of French nationals, parents of French children, refugees, the self-employed, and others eligible for a residence permit are included.

Sources: OECD 1998; Krueger 2000.

much in the future. Indeed, Krueger finds that migration within the EU takes place at only half the rate found in the United States — 2.8 percent of Americans moved across state boundaries in 1987, but only 1.1 percent of Germans, 1.1 percent of Britons, and 0.5 percent of Italians moved from one region to another within their respective countries that year. In Europe, at least, the gains from integration thus far have been through international trade, not free mobility of labour.

Canada within a Continental Labour Market

Any attempt to address the potential implications of reducing barriers to labour mobility or even going so far as to create a common market in labour in North America requires some quantitative assessment of the current state of trade and wages in Canada and the United States.

The 1990s saw a number of important developments in both product and labour markets in the two countries that bear directly on the issue of how the Canadian economy would adjust to an open continental market in skilled labour. The relevant literature on Canada-US comparisons is of three types: explanations of the observed increase in wage inequality across skills groups in Canada and the United States, explanations of the Canada-US productivity gap, and explanations of the large growth in trade and investment subsequent to the implementation of the FTA in 1988 and NAFTA in 1993. A single economic theory or model that accommodated all of the main facts in these areas would be an extremely useful aid to evaluating the potential consequences of Canada-US labour market integration.

From the literature, four important stylized facts emerge about Canada-US trends, post–free trade. First, significant differences remain between wages in the two countries — although there are measurement problems, the average gap in real incomes is in the range of 20 to 30 percent. More relevant, perhaps, to the issue of the mobility of skilled labour are starting salaries for recent university graduates. According to a Canadian government report,

> After taking inflation and purchasing power parity into account, the median annual earnings of bachelor's graduates working in applied and natural sciences jobs upon arrival in the U.S. was $47,400, considerably higher than the $38,400 earned by their counterparts in Canada. The gap in salaries between bachelor's graduates in health occupations upon arrival in the U.S. and those who remained in Canada was similar. (Canada 1999, x.)

Second, overall earnings inequality has increased in both countries. In 1971, a worker at the ninetieth percentile of the wage distribution in the United States earned 266 percent more than a worker at the tenth percentile; by 1995, that worker was earning 366 percent more (Acemoglu 2000). Moreover, education does not explain much of this growth in inequality — studies show that as much as 60 percent of the observed increase in wage inequality has been within groups that have the same education and age.

Third, the labour productivity gap between the two countries' total economies and their manufacturing sectors not only remains substantial, but appears to have widened in the latter part of the 1990s — in manufacturing, the gap widened from 12.3 percent to 29.6 percent between 1995 and 2000, largely, it is thought, to the superior performance of the United States in "New Economy" sectors such as information technology (IT).

Fourth, trade and FDI between the two countries have grown dramatically. For Canada, exports as a percentage of gross domestic product grew from around 26 percent in the mid-1980s to 46 percent in 2000, mostly in "Old Economy" sectors. By 2000, the United States accounted for almost 85 percent of Canada's merchandise exports and for 63.9 percent of inward FDI stocks in Canada.[5]

An Explanation of the Divergent Canadian and US Economies

Most static theories of trade predict economies to converge in response to increased and more open trade. Therefore, to explain the divergence of the Canadian and US economies during the 1990s one needs, at a minimum, to append some dynamics to the basic international trade framework.

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[5] It is also interesting that the cost of capital equipment relative to that of labour rose by about 30 percent in Canada compared with the costs of such factors in the United States during the 1990s, while the intensity of investment of Canadian industry in machinery and equipment fell (see Harris 2001; Lafrance and Schembri 2000).

The 1990s were, of course, characterized by a number of events — such as domestic macroeconomic policy developments, the Asian monetary crisis of 1997-98, and internal domestic political events - that might be sufficient to explain the divergent Canadian and US economies, but it is tempting to look for broader factors that might be at work.

In the past few years, some promising new theories have emerged — having to do with the acceleration of skill-biased technological change (SBT), or the wide-scale introduction of a new general purpose technology (GPT) — that add a significant dynamic element to otherwise static theories and offer a reasonable explanation of recent Canada-US trends.[6] A basic assumption of these theories is that an economy-wide acceleration of technological change rooted in the IT sectors is taking place, which is increasing both the wages of skilled labour in the United States and within-group inequality.

The same forces are at work in Canada, but the pace of change in this country lags that in the United States. Canada's weak productivity performance in manufacturing, together with the fact that most IT capital is imported, jointly explain the two countries' real wage gap, particularly for skilled workers. Also, the much faster growth of the relative supply of highly educated labour in Canada than in the United States means that the premium placed on skills has increased less dramatically in Canada than in the United States.

More important, however, is the fact that, if historical experience is a guide, returns to learning and highly specialized skills that come with the introduction of a new GPT will persist for some time, which has a number of implications both for labour markets and for the process of globalization, including labour migration. The dramatic increase in bilateral Canada-US trade since the late 1980s is a consequence not only of policy (the free trade agreements

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[6] An extensive literature exists on this issue; see, for example, Acemoglu (2000) for a survey of SBT, and Helpman (1998) for discussion of the implications of GPT-based technological change.

— but also of new technologies that have reduced the costs of trade in final goods and made possible the reorganization of production processes across borders, leading to greater specialization and increased trade in intermediate products. It is likely that this process will continue for some time, leading to increased dispersion of outcomes across workers, industries, and firms and increased innovation over a number of decades. Productivity growth will continue to forge ahead before levelling off as the IT-based GPT matures.

In light of this framework in which to think about economic development of the North American economies, what implications does it carry for the consequences of crossborder labour market integration over the next few years? The facts dictate a starting point where the average level of labour productivity is lower in Canada than in the United States but perhaps converging toward US levels. With growth driven by an IT-based GPT, certain skills will be in high demand but in increasingly short supply, and the wages of people with those skills should remain high. Since Canada is both geographically close to the United States and relatively abundant in skilled labour, medium-term migration pressures on such people will remain high.

What about the fate of unskilled Canadian labour in the context of continental free labour mobility? In fact, by Mexican standards, "unskilled" Canadian workers are mid-skilled and, in any case, Canada no longer has manufacturing sectors that make intensive use of low-skilled workers — such products are already imported from developing countries such as China and Mexico. Moreover, the wage gap between US and Canadian mid-skilled labour is much lower than for skilled labour. Thus, the introduction of continental free labour mobility probably would not have much of an effect on Canada's pattern of comparative advantage (including outsourcing) nor would it bring much pressure from low-skilled Mexican or mid-skilled US migrants, simply because NAFTA has already induced most of the adjustments in sectors making intensive use of low- and mid-skilled labour.

The only remaining issue is whether, with free mobility, Canada would absorb some very low skilled Mexican workers and start building some of the labour-intensive export industries one sees in the southern US states. Without detailed quantitative modelling, one cannot be sure, but, with the possible exception of agriculture, the likely answer is no, since these kinds of industries are also absent from northern US states. To the extent that Canada absorbed more very unskilled labour, it would likely be in parts of the services sector.

Productivity Effects

What effect would the increased migration of skilled workers from Canada to the United States likely have on the labour productivity gap between the two countries? In general, the out-migration of skilled labour would reduce the average labour productivity of unskilled labour if skilled labour and capital substitute for unskilled labour — which certainly seems to be the case empirically.[7] A potentially more damaging effect of the out-migration of skilled labour would be to slow the pace at which the new GPT was being absorbed and adjusted to within the Canadian economy.

At the same time, however, greater competition for skilled workers could have a beneficial effect on productivity growth as firms are forced to innovate and adapt in those areas where productivity improvements through the use of technologies based on the new GPT are most suitable. Further, one of the most important lessons about GPT-based technological growth is that it makes technology-specific learning necessary — that is, people who are otherwise highly educated have to learn to use the new technologies if their productivity is to rise. For Canada, increased labour mobility should have two important effects in this regard. First, since increased mobility should expose more workers to a wider range of technological experiences, such experiences will prove more valuable when these people are employed within Canada. Second, greater competition for the technologically adept should raise the wages of such people and, by demonstration, encourage other highly skilled people to acquire the knowledge necessary to take advantage of the new technologies.

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[7] The large literature on SBT deals with this issue. The elasticity of substitution between skilled and unskilled labour is in the order of 0.5 to 1.0 (see Murphy, Riddell, and Romer 1998).

Overall productivity convergence should also lead to real wage convergence, thus reversing the trend of the 1990s. This may also occur in the absence of labour market integration. The only difference would be that the pace of average real wage convergence would be faster with labour market integration than without.

Wage Inequality

As we have seen, most SBT-GPT hypotheses emphasize that some form of technology-specific learning allows some individuals to capture the benefits of the new technologies, leaving those working with old technologies facing reduced demand for their services and, ultimately, obsolescence. Then, as the new GPT moves toward the middle phase of its adoption, wage inequality tends to rise. This hypothesis explains the fact that wage inequality rose less in the 1990s in Canada than in the United States simply because the new technologies arrived somewhat later in Canada. Thus, holding existing barriers to labour mobility constant, one would expect that Canada's inequality levels should rise with the introduction of the new GPT, then subsequently fall as the GPT matures. If one assumes that the new GPT is now moving into its middle phase in the United States, the integration of the Canada-US labour market most likely would accelerate the pace at which Canada would have to adapt to US technological standards. In some sectors, this has already happened; in others, it would almost certainly quicken the pace of structural adjustment. Thus, over the longer term and given a fully integrated labour market, wage distributions would tend to converge across the two countries, and remaining wage inequality would reflect the relative returns to GPT-based skills on both sides of the border.

Agglomeration, Convergence, and Regional Development

When looking at the positive and normative effects of increased labour mobility, a key issue is its potential effect on the geographical distribution of economic activity within a more integrated North American market. Traditional trade theory has little to say on this subject, but it has become the central question in theories based on the so-called new economic geography initiated by Krugman (1991). These theories predict that, in some circumstances, increased factor mobility can lead to divergence in regional income levels and the concentration of economic activity in some regions at the expense of others. On the other hand, a considerable body of theory and evidence also suggests that increased integration leads to convergence of regional income levels. Which of these two views offers a better explanation of what might happen in North America in the event of increased international labour mobility?

Agglomeration and Divergence

The new economic geography generates forces of agglomeration by assuming both economies of scale and costs to trade — including transport costs, border costs, and other transaction costs associated with interregional goods trade, or more formal barriers to trade such as tariffs and quotas. With or without factor mobility, these models are subject to cumulative causation effects. In particular, factor mobility reinforces gains to regions that tend to attract industries characterized by economies of scale due to their size. This advantage translates into higher productivity and higher real incomes, which then attracts additional factors by migration. Manufacturing production (assumed to exhibit economies of scale) tends to concentrate where there is a large market, and a market is large where manufacturing production is concentrated — a force known as "backward linkage." This is reinforced by the fact that costs of living are lower in the region with the larger manufacturing sector because consumers there rely less on imports that are subject to transport costs — a force known as "forward linkage." Both forces tend to favour the agglomeration of people and firms in the core, leaving other regions (or countries) de-industrialized. Large regions become larger, and a core-periphery pattern of economic development emerges.

The predicted outcome of this theory is sensitive to the specification of trade costs. Assuming free trade and no trade costs, this asymmetric pattern of development cannot occur. Trade costs, however, are unlikely to be zero, which lends credence to the view that freeing up labour mobility may "hollow out" some regions of a free trade area — particularly the smaller ones — resulting in the loss of industry and skilled people. In the absence of labour mobility, the cumulative causation effect is reduced and de-industrialization is less likely. The models still predict the possible emergence of permanent income and productivity differences but, in the absence of a migration channel, the de-industrialization effects are much less pronounced.

Thus, for small regions within existing common markets, the policy issue is clear: free movement of labour may, in fact, lead to lower incomes. For existing free trade areas contemplating reducing barriers to labour mobility, the possibility that some regions might become peripheral in a large integrated economic area is obviously worrisome. The applicability of this question to the European Single Market is obvious and has generated a great deal of research on regional development patterns within Europe. Although the evidence is not yet clear, early comparisons of US states to EU countries suggested that actual outcomes differed from those the model predicted. In the United States, where labour mobility is high, it appears that incomes were levelled but that industrial development was relatively uneven. In Europe, however, where labour mobility historically has been low, income levels across countries exhibited a great deal of variability but industrialization patterns were more balanced.

The early models generated by the new economic geography worked with the polar cases of perfect mobility or complete immobility of labour. Moving to the more realistic case of imperfect mobility leads, however, to some important differences. As Ludema and Wooton (1999) show, with imperfect labour mobility and the appropriate choice of the sequence of trade versus labour market integration, it is possible to avoid the potentially negative effects of agglomeration on smaller regions. Of particular interest, they find that, *for a given level of trade costs, increased labour mobility tends to level the agglomeration effect*. Regions within NAFTA, now characterized by relatively free but not costless trade, are subject to agglomeration forces. Since there is free mobility of labour between US regions but not across the Canada-US border, Canada (the smaller region) may have been pushed to some degree toward specialization in sectors not subject to the benefits of agglomeration under free trade. The Ludema-Wooton model then predicts that, holding the trade regime constant, increased labour mobility would tend to lead to more even patterns of industrial development across international borders. The policy implication of the Ludema-Wooton result is that an increase in labour mobility between Canada and the United States could benefit Canada, the smaller country, even if agglomeration economies are significant.

For a more practical look at the likely effect of a common market in labour, the US experience is instructive. It seems reasonable to assume, for example, that the variability of incomes (before tax and transfers) and industrial specialization among US states reflects what might occur between US and Canadian regions. Clearly, opening up the US labour market to Canadian labour would have a much greater effect on regional development in Canada than would the converse. It is also useful to note that local demand linkages for some smaller Canadian regions would not likely be important even with some trade costs — exports of manufactured goods would tend to be relatively more important for these regions than would production for local use. Assuming that skilled labour is the main target of mobility-enhancing policies, those Canadian regions with the widest wage gaps with their crossborder US neighbours and with the smallest markets would be affected most visibly in the short run. Over the longer run, however, the reduction in trade costs and the benefits of specialization could lead to a convergence of income levels. On the other hand, since proximate regions on both sides of the Canada-US border tend to resemble each other, the effect on smaller Canadian regions of reducing labour mobility costs might not be large if labour is attracted to move to the adjacent US border region. To put it another way, most of the potentially damaging effects of labour mobility have already occurred in small markets such as Atlantic Canada by virtue of free labour mobility with the rest of Canada. Opening the border to free movement of labour is less likely to affect Atlantic Canada given the similarity of wages there and in neighbouring New England states.[8]

Convergence

An alternative empirical approach to regional development is based on the convergence hypothesis, which states that increased economic integration leads to faster rates of convergence of income and productivity levels. The evidence supporting this hypothesis is mixed, and much of it relates to trade integration — for example, Ben-David (1993) finds that trade integration has a large effect on convergence, while Barro and Sala-i-Martin (1992) and Coulombe and Lee (1995) claim to find similar effects using US state and Canadian provincial data.[9] Generally, however, there appears to be no strong case that greater labour mobility leads to faster rates of convergence in productivity. Hulten and Schwab (1993), in fact, find the opposite for US states. More recent work on European regions finds significant evidence of productivity convergence over the 1990s (see Gugler and Pfaffermayr 2000).[10] Important examples remain, however, of subnational regions where convergence has failed to occur despite free mobility of labour, raising fears about the possible consequences of greater economic integration.

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[8] For an interesting look at the potential effect of the economic integration of Quebec with its neighbours in the US northeast, see Proulx (1993); see also Courchene and Telmer (1997) on the relationship of Ontario and the mid-Atlantic and midwest US states.

[9] For a review of the theories and evidence, see Harris (1996).

[10] One prominent example of a complete failure of convergence despite free trade and full labour mobility is that between the former East and West Germany.

The Brain Drain and Knowledge Transfers

The Canadian policy debate on North American labour migration has focused almost exclusively on the brain drain from Canada to the United States of professionals in the medical and high-technology fields, business managers, and scientists and engineers. The major concern is that current flows represent the best and brightest Canadians, and there is some evidence that this is indeed the case. It is important, however, to gauge the actual extent of the mobility of both people and ideas, in order to assess the incremental effect of moving to a common Canada-US labour market.

How Mobile Is Highly Skilled Labour in North America?

Some people argue that skilled labour is already highly mobile across the Canada-US border and, thus, that any further freeing of labour mobility is likely to have little incremental effect. Perhaps the analogy most frequently made is between mobile brains and FDI. Since both factors are regarded as highly desirable and in short supply, competition for them has created a seller's market that allows them to choose among competing locations. Moreover, since both brains and FDI are viewed as engines of economic growth and employment, there is considerable tax competition to keep and attract these highly internationally mobile factors.

This analogy between brains and investment is instructive and contains a lot of truth. Recent surveys report a dramatic willingness on the part of students in science, engineering, and business to move to the United States for employment purposes. One survey reports that "[t]he majority of respondents (78%) indicate that they are willing to relocate to the United States, and 88% are willing to relocate within Canada. Overall, only 12% of respondents indicate that they would *not* consider relocation [emphasis in original]."[11]

It useful to remember, however, that the recent drain of Canadian brains to the United States emerged from a decade-long economic boom coupled with shortages of certain critical skilled labour south of the border. In addition, the expansion of the United States' H1-B visa program has, to a considerable extent, been an endogenous response to that boom. Tax competition between jurisdictions, which lowers effective marginal rates on income earned by human capital, can be viewed as an efficiency-enhancing outcome of this process — but is it permanent?

The United States continues to attract large numbers of able people wishing to study in specialized fields such as science and engineering, and many of them wish to pursue careers in that country upon graduation. A National Science Foundation study notes, for example, that

> Between 1988 and 1996, foreign students from major Asian and European countries, Canada, and Mexico earned over 55,000 U.S. [science and engineering] doctoral degrees....During this period, about 63 percent of these doctoral recipients planned to remain in the United States after completion of their studies, and about 39 percent had firm plans to do so. (Johnson and Regets 1998.)

The same study reported that 43 percent of the Canadians in its survey intended to stay in the United States.

Controlling the supply of labour for specific occupations is, of course, one of the conventional rationales behind national immigration policy. A firm commitment to increase mobility permanently within a common market for labour essentially forgoes that margin of immigration control in favour of a more liberal regime. Indeed, Canada has reasons to favour a more permanent labour mobility regime for human capital that are similar to those that were used to argue in favour of removing the power to tax trade under the FTA. Given the increasingly highly specialized nature of human capital, any Canadian who undertook the lengthy training required to qualify for employment in one of these areas would greatly reduce his or her risk of not finding a suitable position if the relevant job market was expanded to include the United States. Thus, an expanded job market would benefit not only Canadian suppliers of labour, but also the sectors providing the necessary training and the economy at large. Moreover, there is always the risk that, as it has done with tariffs, the United States will use immigration controls as political devices for rent sharing, and in highly unpredictable ways, which could be detrimental to Canada.

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[11] "Today's Technology Graduate: Mobile, in Demand & Demanding!" *Personnel Systems*, Ottawa, 1999, p. 3.

Growth and Knowledge Transfers

The traditional concern about the brain drain is that the transfer of scarce human resources from one country to another increases the rate of economic growth in the receiving country relative to that of the country the migrants are leaving. Part of the Canadian concern about allowing the increased mobility of skilled labour, therefore, is that doing so would simply exacerbate the brain drain to the United States to the detriment of Canada's economic growth rate.

One could argue, however, that there are at least two ways in which a brain drain could lead to *faster* growth in the country that is losing talented individuals. First, a brain drain might foster investments in human capital (see, for instance, Stark, Helmenstein, and Prskawetz 1998); second, a brain drain could lead to higher growth rates through the transfer or spillover of knowledge generated by the brain drain.

Consider the first argument. Although any individual contemplating migration will be uncertain about the level of income he or she is likely to receive in the new country, that income is likely to be higher if the individual's skill level is high. In turn, that skill level is a positive function of training and investment in human capital. Thus, someone who is thinking about migrating is likely to invest more in human capital than someone who does not want to migrate because such an investment would improve that individual's chances of success abroad. Of course, this additional investment in human capital also increases the probability that the individual will actually migrate. Not everyone who invests in human capital will migrate, however, and not everyone who migrates will be successful abroad — at least some of those who are unsuccessful will return to their country of origin. As a result, the average human capital could increase in the source country even in the presence of a brain drain. In addition, if these effects are strong enough, the growth rate could increase, rather than decrease. Indeed, in a study of 37 developing countries, Beine, Docquier, and Rapoport (2001) find evidence of just such a "beneficial brain drain" growth effect. This effect applies to developed countries as well, at least insofar as investments in human capital are a form of insurance: individuals who invest in human capital are simply retaining their option to move abroad if the possibility arises.[12]

The second argument, to repeat, is that the migration of the highly skilled could have a positive impact on knowledge spillovers between countries, in the following way.[13] When international knowledge transfers are low or if other inputs, such as knowledge capital, are not readily available in a particular country, skilled individuals in that country could be obliged to migrate in order to take advantage of their skills — to carry out innovation activities, for example. From the point of view of the world economy, it would be efficient if such skilled individuals were permitted to migrate to the country where they can find the inputs that best complement their skills. Thus, if knowledge spillovers are important, the country that experiences the brain drain could benefit from an economic growth rate that was higher than if the brain drain did not occur. Indeed, in this scenario, both the country that loses brains and the country that gains them would benefit from higher growth rates than would have occurred if labour were completely immobile.

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[12] Non-English-speaking immigrants to Canada who choose to locate in an English-speaking, rather than French-speaking, part of the country represent a simple form of the same phenomenon, since learning English gives them more options and greater potential mobility, than learning French.

[13] This second argument is developed in more detail in the essay by Harris elsewhere in this volume.

Moreover, network effects could benefit the country of emigration even further, in the sense that skilled nationals who have migrated are better able than others to use their insiders' knowledge of their country of origin to channel FDI and other resources back home. This process has given rise to the suggestion that the phrase "brain drain" be replaced with "brain circulation," particularly in reference to scientists, the idea being that the creation of knowledge is increasingly a global industry with relatively rapid international spillovers. Thus, freeing the international mobility of labour could increase the pace at which knowledge moves from one country to another.

New Forms of Labour Mobility

The TN visa program that the United States established in the wake of NAFTA is a case of "policy ahead of theory." The original motivation for the program was to allow business to provide customer and related technical support essential to the modern economy. Often, highly firm-specific tacit knowledge can be transferred only in close physical proximity to the customer. In addition, activities such as sales, advertising, and management of subsidiaries of multinational enterprises often require repeated visits to the foreign market. The TN program was explicitly designed to facilitate these types of activities across NAFTA borders. Although the program has evolved into much more than that — a form of temporary mobility for certain types of professionals — it stands as an important example of a successful policy designed to facilitate modern international business. It also allows one to imagine the delivery of labour services across borders through means other than those that reflect a permanent migration decision. In this section, we outline some of those types of labour market activities.

Temporary Visits Associated with Related Business Services

The motivation of allowing temporary visits associated with business services, as under the TN visa program, is, as noted above, to facilitate trade, particularly where close interaction with the customer at the point of delivery, follow-up service related to previous sales, or preliminary interactions with the customer prior to sale are important aspects of the job. For many types of modern goods and services, these activities are an essential part of business. In general, NAFTA already provides a fairly high degree of mobility for many of these activities, but improvements are possible, particularly with respect to border procedures.

Border communities, such as Detroit-Windsor, are particularly affected by impediments to the free flow of labour services. Labour market regulations not covered by trade agreements — such as union membership restrictions — also impede the free flow of labour services, particularly in the film industry, for certain types of health professionals, and for pilots, engineers, technicians, and the construction trades. "Deeper integration," which would facilitate temporary labour movements in these areas, will require fairly major changes in the way in which some occupations are organized and regulated.

Virtual Mobility and E-Labour Markets

Innovations in communications technology such as the Internet and private data networks have given firms and individuals the ability to transmit large volumes of voice, text, and image data instantly and at close to zero marginal cost to anywhere in the world. These innovations have already had a major economic effect on many forms of business. Their effect on labour markets is also under way in areas such as the delivery of software coding and the growth of call centres.

Of particular relevance is the ability of such communications innovations to remove the barriers to delivery of certain types of services. The international trade literature draws a common distinction between services and goods. For commodities with a sufficient degree of durability and transportability, production can be divorced from consumption. Trade is realized by the transport of goods from the location of production to the location of consumption. Services transactions, on the other hand, are often characterized by the requirement that buyers and sellers physically meet. Delivery of labour services has also traditionally been characterized by the proximity of the worker and firm. Yet many labour services — such as software engineering, data entry, translation services, and distance teaching — could, in principle, be delivered electronically, which raises the prospect of a continental e-labour market for such services. As in the definition of any market, the key issue is the degree of substitutability between alternative sources of supply — in this case, the virtual and the physical supply of factors. Firms could source labour via the Internet when it is technically possible and cost effective.

The economic literature on this subject is not yet large but it is certain to grow in conjunction with the emerging field of Internet economics. One issue related to the earlier discussion of agglomeration and regional development is the effect of e-labour markets on particular regions within NAFTA (for a theoretical discussion, see Harris 1998). In this case, however, the general fear that agglomeration might be biased against the smaller country is unfounded. On the contrary, the emergence of e-labour markets is likely to result, not just in greater specialization by skilled labour in the integrating region as a whole, but also in a dramatic increase in market size for the specialized labour services provided by the smaller regions. With virtual labour market integration, smaller regions could sell more specialized labour services to a much larger market.

In a fully integrated, virtual labour market, the geographic location of the point of origin of labour services should not, in principle, be a barrier to sourcing. However, it will be necessary to reduce regulatory and trade barriers to firms and individuals in these types of virtual employment arrangements for North American e-labour markets to evolve. Most contractual relationships between workers and the firms that employ them are heavily conditioned by local labour laws and various tax policies. New forms of crossborder worker-firm contractual relationships would facilitate the virtual mobility of labour services, expand the North American market for such services, and potentially increase the employment of skilled labour in regions where job growth has been inadequate.

Although few restrictions on the development of e-labour markets currently exist beyond general labour market regulation, this could change in the event of opposition from labour groups that might be adversely affected by such competition. Thus, further integration of the NAFTA economies should include provisions that guarantee the right of North American labour to deliver services electronically to any location in North America when this is technically possible and economically desirable.

Crossborder Variations in Labour Demand

Regional labour markets and particular industries in those regions are subject to idiosyncratic demand and supply shocks that are not the result of macroeconomic or cyclical shifts in demand (which we discuss in the next section).

The risk of such shocks has two implications. First, it gives rise to demands for insurance arrangements to reduce the income risk associated with these shocks. Second, efficiency gains may be had if it is possible to move labour from locations where productivity is temporarily low to locations where it is high. At the same time, however, the increasing specialization of labour has compounded the potential severity of the problem, in that the supply of highly specialized talents is often quite inelastic in the short run. In such cases, therefore, increasing the mobility of these skilled individuals would be critical. Regions that lose people with highly specialized skills to other locations would, it is true, suffer obvious short-run costs. In the longer run, however, the larger labour market that would be open to specialized labour through increasing economic integration would tend to reduce income variability and unemployment risk in such occupations and increase the long-run supply of individuals with these talents.

As we discussed earlier, the regional mobility of labour, even within existing common markets, is quite low. The actual extent to which region-specific variations in labour demand could be facilitated by moving workers in a short time frame is an unresolved empirical question. Historically, however, Canada has seen some large interprovincial labour flows in response to economic booms and busts in particular regions. In principle, therefore, there is no reason this could not occur across international borders. Canadian labour flows historically have been east-west, but the existence of a north-south option might change this pattern considerably. The closer proximity of northern US states, rather than distant Canadian provinces, might lead Canadians to respond to local employment shocks by temporarily moving southward. Likewise, booms in proximate Canadian provinces might give rise to temporary inflows of more closely available US labour.

To the extent that workers' choices expanded through the creation of a North American labour market, their increased mobility would lead to an unambiguous welfare improvement and, moreover, would tend to raise expected income. Note that the total welfare benefits to this type of mobility are particularly important for nontraded sectors such as construction or health care, where imports cannot provide an alternative source of supply. The welfare benefits of greater labour mobility thus would include a more secure source of supply with more stable prices than would otherwise be the case; furthermore, these benefits would accrue not just to mobile labour but also to local consumers.

Historically, workers who are the most easily mobile tend to be younger, whether skilled or unskilled, for whom the costs of a temporary move are much lower than for older workers and those with working spouses or dependents who are not mobile. Canada's aging population thus implies that the potential supply of temporarily mobile workers is falling. One obvious response to this declining supply is to make a particular effort to encourage the immigration of younger workers to Canada; another response, however, is to increase the temporary crossborder mobility of workers, both skilled and unskilled, from the United States.[14]

Seasonal Labour Demand and Supply

One of the most important differences between Canada and at least the southern United States is weather. Winter is a reality many Canadians would like to forget, and it affects labour supply and demand in a large number of sectors. Currently, however, beyond a few isolated occupations (golf instructors, professional hockey players), there is little in the way of seasonally oriented north-south labour flows. There are, however, many climate-motivated moves — it has been estimated that more than 2 million Canadian-born people live in California. A significant fraction of the population of retired Canadians winters in the southern United States; these people do not work, of course, and from a macroeconomic perspective they contribute significantly to a tourism deficit. The full extent of the "snowbird" migration is unknown, but a 1997 estimate put the number at about 1.5 million and growing rapidly.[15]

A full common market in labour services between Canada and the United States could affect the movements of these people, although to what degree remains unclear to us. Winter certainly would induce a larger number of people who possess skills that are transportable to southern US locations to make this seasonal move. Most of us in the education business, for example, already know of people who do this. Other occupations, such as the building trades, tourism, consultants of all types, health workers, and agricultural workers, also contain large numbers of people who might take advantage of increased mobility.

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[14] Although both Canada and the United States have aging populations, the aging trend is less dramatic in the United States than in Canada, largely due to differences in the two countries' birth rates. The United States, therefore, is more likely to be a source for young temporary workers for Canadian labour markets than the reverse.

[15] "Canadian snowbirds face taxing plight," *Financial Post*, October 8, 1997, p. F7.

For retired Canadians, the issue of crossborder labour mobility is almost never discussed, but an aging population and its implications for pensions and health programs could move the issue higher on the agenda. To the extent that part-time or temporary work is a viable policy option for the aging, making this option available to retired Canadian snowbirds would be highly significant and valuable both to them and to Canada. The two countries could arrange, for example, for unemployment or pension benefits not to be portable across national borders for workers past a certain age, which would increase the attractiveness of such people to potential employers and increase the number of older workers who want to stay in the labour force after the normal retirement age. For both countries, the fiscal and real output benefits would be favourable.

Mobility and Macroeconomic Adjustment

An alternative perspective on labour mobility is provided by the macroeconomic literature on regional adjustment mechanisms and the related literature on the costs and benefits of optimal currency areas.[16] Within an integrated economic area characterized by high factor mobility, factor flows could be an important adjustment mechanism to asymmetric shocks across regions. The alternatives to adjustment through migration are changes in wages, exchange rates, labour force participation rates, and unemployment rates. A potential benefit of increased labour mobility within a larger economic area would be the ability of more flexible labour markets to deal with asymmetric regional macroeconomic shocks.

In principle, the literature assumes that adjustment is more efficient and flexible the greater the response of wages and migration to a shock, as opposed to changes in unemployment or participation rates. Indeed, this issue is central in the empirical literature on adjustment mechanisms within the EU. Given the completion of the European Monetary Union and the arrival of the euro, with substantial wage rigidity and other forms of labour regulation in the EU, the loss of the exchange rate as an adjustment mechanism puts greater weight on the migration channel for adjustment. The general worry is that the EU's labour markets are relatively poor at adjusting — in particular, that labour mobility is quite low among EU countries. As we discuss below, the usual benchmark for comparison is the interregional migration of labour within the United States.

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[16] Most of the empirical literature on optimal currency areas and asymmetric shocks takes the state of labour mobility as fixed. The question in this section is how those adjustment costs would change if formal restrictions on crossborder flows were reduced. This may or may not result in increased labour mobility.

It is important to note, however, that this question is of interest independently of whether NAFTA countries are on a flexible or some form of fixed exchange rate regime — even under flexible exchange rates, increased crossborder labour mobility would be a valuable adjustment mechanism.

European and US Evidence

In considering how an integrated labour market in North America might adjust to macroeconomic shocks, we might usefully examine the cases of the EU and the United States. Both have formal common labour markets with permanent labour mobility rights for all workers. If Canada's labour market were to be integrated with that of the United States, an obvious question is whether, on a North- South basis, the degree of labour mobility would converge toward US levels or toward European levels. The difference is significant.

The general view of labour mobility within the EU is that, in contrast to the United States, it is exceptionally low. In addition, labour market shocks in the EU are mainly accommodated by changes in the labour force participation rate, rather than by migratory responses. The lagged response of migration to changes in employment in the EU is, moreover, exceptionally long. Decressin and Fatas (1995), for example, find that, after the first year, the response is precisely zero, while after two, three, and four years, 27, 45, and 80 percent, respectively, of the shock in labour demand is accommodated by migration. In the United States, in contrast, Decressin and Fatas find that the relevant number is 52 percent within the first year, a result confirmed by Barro and Sala-i-Martin (1995, 195), who, interestingly, also find evidence that income differences seem to play a relatively minor role in explaining migration in the EU but a more significant role in the United States. Puhani (2001) finds that, over 1.66 years, 29.6 percent of a decrease in unemployment in Germany is accommodated by an increase in migration, while in France and Italy it is a much lower 8.4 and 3.7 percent, respectively, which leads him to conclude that labour mobility is an inconsequential adjustment mechanism within the EU.

The contrast between the US and European experience carries mixed messages for the Canada-US case. Most labour market specialists view Canada as lying somewhere between the United States and the EU in terms of its labour market adjustment mechanisms and unemployment experience. This perspective suggests that full labour mobility between Canada and the United States might serve to increase Canada's macroeconomic adjustment capacity by more than has been observed in the EU but less than has been the case in the United States. An alternative view, however, is that these types of changes come about only very slowly, and involve fundamental changes in the life experiences and perspectives of workers. It is worth recalling that, historically, flows of labour across the Canada-US border have been very large. Under a more liberal migration regime — particularly one that eliminated uncertainty as to access rights — it is quite possible that the US benchmark could prove more relevant and that Canada's ability to make macroeconomic adjustments would improve.

Policy

In this paper, we have examined potential interactions between deeper North American economic integration and increased labour mobility between Canada and the United States. We have also identified a number of channels through which increased labour mobility might affect the Canadian economy and some its positive and normative implications. While NAFTA is still a long way from a common market with permanently enshrined mobility rights for workers, a number of factors are pushing in that direction. The terrorist attacks of September 11, 2001, and subsequent concerns about border security certainly raise additional concerns as to how to manage the border. They do not, however, fundamentally change the economic case for improved labour mobility within the NAFTA countries.

There is, admittedly, little formal discussion of taking NAFTA toward a common labour market. At the same time, ongoing integration from the bottom up is giving rise to greater crossborder labour flows and to demands to facilitate these flows.[17] Policy can be either in front or behind on this process. Canada's entering a formal agreement to open its labour markets in some permanent way to the free movement of labour from other NAFTA countries undoubtedly would be seen as sacrificing national sovereignty. With this cost, however, would come benefits. It is possible that, as in the case of freer trade in goods, the forces of integration and globalization benefit most those countries that successfully adapt to the demands for greater mobility of people. For relatively small economies such as Canada's, failure to do so could mean losing investment and human capital to jurisdictions that adapt more effectively.

The issues we have raised suggest a number of medium-term policy options for Canada and the United States, short of a common labour market, that would enhance labour mobility in the northern part of the continent. Each of these options deserves a more serious examination.

First, the NAFTA TN visa program, which has increased mobility for professionals and others with a technical university degree, should be expanded to cover other classes of labour by creating a negotiated schedule of dates for liberalizing the movements of various occupations. Generally, one could imagine moving from the highest to the lowest skill categories. Certainly, it would be relatively easy to extend the program to technical and trade workers, for example.

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[17] For a discussion of bottom-up versus top-down integration, see Harris (2001).

Second, ways should be found to amend procedures at the Canada-US border to reduce transactions costs for citizens of one country who seek work in the other. Furthermore, it would be useful for the two countries to coordinate border management with respect to non-NAFTA nationals.

Third, the two countries should seek to encourage the growth of e-labour markets by reducing barriers to firms that are, or might be, virtual employers. New legal forms of crossborder worker-firm contractual relationships should be created to facilitate the e-mobility of labour services across the border. This, in turn, would expand the North American market for virtual labour services, and potentially increase employment opportunities for skilled labour in rural and resource-poor regions. At the same time, governments should spurn calls for restrictions on e-mobile labour services by groups that might be adversely affected by this type of competition.

Fourth, a joint Canada-US task force should be struck to work on harmonizing professional and occupational standards and eliminating entry barriers such as residency requirements for licensing. In many instances, removing such obstacles would require cooperation between US states and Canadian provinces. In some areas, the issue of standards could be dealt with by resorting to the principle of mutual recognition; in others, a common Canada-US standard might be required.

Currently there seems to be little will in either Ottawa or Washington to pursue these types of policies or deeper integration of Canadian-US labour markets. Given the economic pressures on both countries to adjust to increasing global competition, however, it is only a matter of time before the issue surfaces on the political and policy agenda. It is our hope that this paper will help to focus attention on the policy-relevant issues and research that will need to be examined when that opportunity arises.

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Brains on the Move

Essays on Human Capital Mobility in a Globalizing World and Implications for the Canadian Economy

Richard G. Harris, Stephen T. Easton and Nicolas Schmitt

with contributions by William Gibson,
Dominique M. Gross, and Antoine Soubeyran

As globalization proceeded in the 1990s, it became increasingly evident that economic growth was being driven less by the accumulation of capital and population and more by ideas and new technologies. The era of the "New Economy" raised the stakes in the global competition to acquire knowledge and develop leading-edge technology. "Brains on the move" became as important as "industry on the move."

In this collection of essays, economists from Canada and elsewhere look at the issues surrounding the movement of our best and brightest talents — both scientific and entrepreneurial — on whom so much of Canada's economic growth depends. To what extent are they being drawn to the United States? What is the cost of such a brain drain to the Canadian economy? With Canada's productivity growth slowing in the past couple of years and the gap between Canadian and US per capita incomes widening, concerns have grown about the migration of highly qualified individuals and entrepreneurs both into and out of Canada. North American economic integration, stalled since the 9/11 terrorist attacks, may gain renewed life, perhaps sooner than many think. The prospect of an integrated North American labour market would then spark a policy debate as intense as the clash in the 1980s over free trade with the United States.

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